TECHNOLOGY

EBRUARY, 1955

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UBLICATION

HOW TO GET THE MOST FROM TIRE ROAD TESTS

see page 627

For outstanding mold lubrication—

AQUAREX® L

Advantages of "Aquarex" L for mold lubrication:

- No corrosion of molds
- Easy releasability
- Efficient for 10 or more heats from a single application
- Minimum mold residue
- Maximum economy

How to use "Aquarex" L:

Use a 1% water solution of "Aquarex" L alone or blended with a 1% solution of silicone emulsion. While solutions of "Aquarex" L and silicone emulsions are both excellent mold lubricants by themselves, a blend of the two materials is even more effective. See Rubber Chemicals Report No. 55-1 for complete details.

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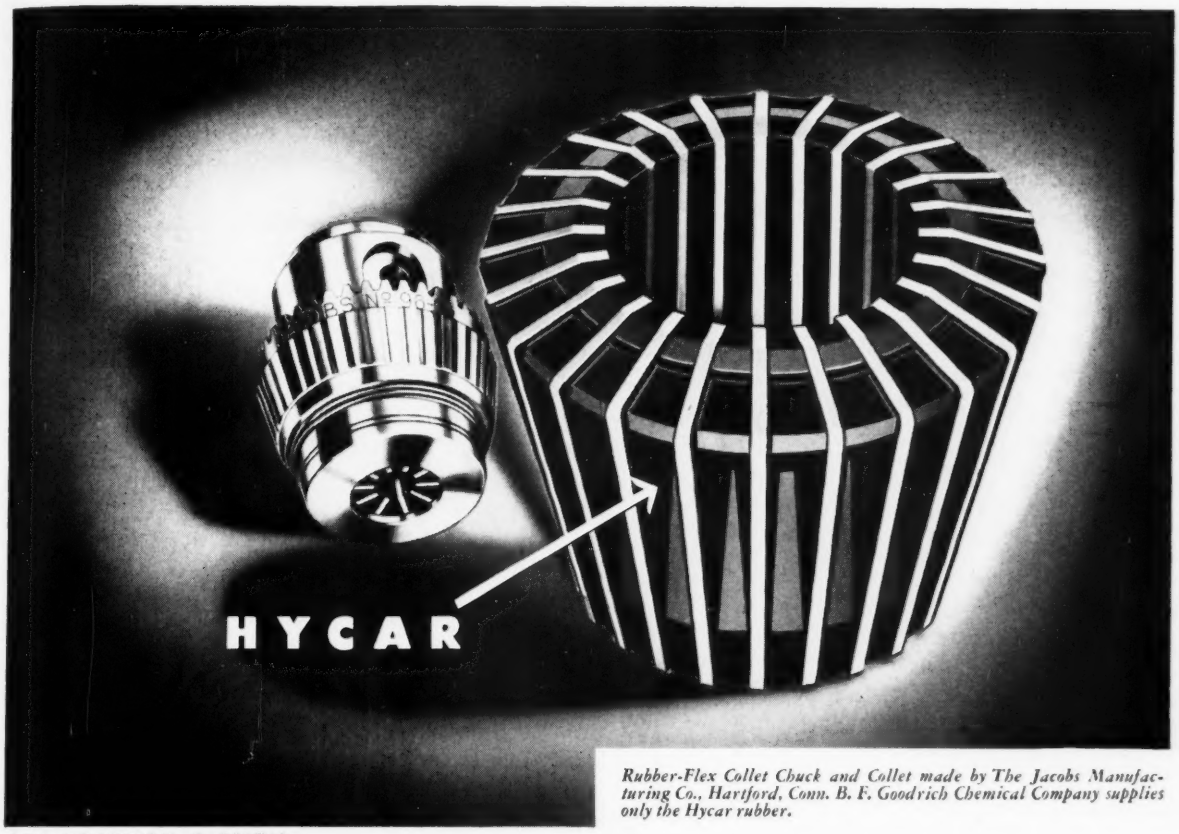
Another new development using

B. F. Goodrich Chemical *raw materials*



Rubber-Flex Collet Chuck and Collet made by The Jacobs Manufacturing Co., Hartford, Conn. B. F. Goodrich Chemical Company supplies only the Hycar rubber.

Left: Jacobs Model 96-05 Rubber-Flex Collet Chuck
Right: Jacobs Rubber-Flex Collet

Rubber-Flex Collet grips steel or glass

11 COLLETS GIVE 88 DIFFERENT SIZE GRIPS

WHEN the Jacobs people, who know their chucks, got together with the Hycar people, who know their rubber, they came up with the new Rubber-Flex collet chuck and the tightest, most accurate grip ever devised.

The chuck's Rubber-Flex collets, made with Hycar American rubber, have a capacity range eight times that of ordinary split steel collets. They come to grips equally well with either tools or work, solid stock or thin-wall tubing, compressible or brittle materials . . . even glass and ceramics.

Hycar rubber is a basic factor in the success of the collet chuck on a whole new range of applications . . . on grinders, jig borers, reamers, and other high precision machines. The Hycar locks the collet's steel jaws mechanically together, insuring an absolutely parallel grip over the entire bearing surface, and actually *tightening* the grip when torque is applied. And vitally important, Hycar effectively resists the deteriorating action of lubes and coolants, withstands shocks and flexing.

Versatile Hycar is used in many industries. It has exceptional resistance to abrasion, oil, gas, heat, cold and many chemicals. Any one or combination of Hycar's qualities may be just what you need to improve a product part or solve a tough product problem. For complete technical service and information on uses for Hycar, please write Dept. CL-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
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For twenty years Phillips scientists have been studying rubber, natural and synthetic, in all its phases. They've experimented with hundreds of recipes . . . they've developed new, better, more economical carbon blacks. And always, they've tested and *tested*. They have *proved* their results.

They have found, for example, that Philblack E can add thousands of miles to the life of an automobile tire. They can tell you how to compound your rubber to disperse heat . . . how to reduce dangerous static electricity in industrial belts . . . or how to make a better covering for cables.

This wealth of knowledge, this practical experience, is available to all Philblack customers. Our technical staff may already have solved the problem that is bothering you right now. Consult our Philblack representative or write for more information concerning the versatile Philblacks.

*A TRADEMARK

Know the Philblacks!

KNOW WHAT THEY'LL DO FOR YOU!

Philblack A FEF Fast Extrusion Furnace Black
Ideal for smooth tubing, accurate molding, satiny finish. Mixes easily. High, hot tensile. Disperses heat. Non-staining.

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Superior abrasion resistance at moderate cost. Very high resistance to cuts and cracks. More tread miles at high speeds.

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Phillips 66

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G-M-F and Dibenzo G-M-F

These two activators from the world's leader in rubber chemicals serve as effective non-sulphur vulcanizing agents when used with certain oxidizing materials.

They are particularly effective and most often used for the excellent heat resistance they impart to butyl rubber products.

Though G-M-F is the more economical of the two, Dibenzo G-M-F, with a more delayed action, gives superior scorch safety and is recommended for use wherever scorching is a major problem.

Both offer excellent resistance to heat and have been widely used in commercial butyl stocks for tire-curing bags, wire insulation, and wherever high temperatures require maximum protection.

For more information on the use and advantages of G-M-F and Dibenzo G-M-F in *your* products, write for our free Compounding Research Report #30.

The chart below illustrates the properties of a typical Dibenzo G-M-F activated CV butyl wire insulation stock

BUTYL RHW INSULATION

Physical Properties Meet the Underwriters Laboratories' Provisional Requirements

GR-I 35	100.0
Zinc Oxide	5.0
Calcined Hard Clay	125.0
Process Oil	1.0
SUNPROOF® IMPROVED	2.0
FLEXAMINE	1.0
M-B-T-S	2.0
G-M-F	1.5
VULKLOR	1.0
TONOX	0.1

UNAGED PHYSICAL PROPERTIES

Seconds at 402° F	200% Modulus PSI	Tensile PSI	Elongation	Recovery Index
35	490	740	360	0.18
U. L. Standard	400 min.	700 min.	300 min.	0.375 max.
Aged 168 hours in an Oxygen Bomb at 80° and 300 PSI				
35	630	610 (83%)	280 (78%)	–
U. L. Standard	–	75%	75%	
Aged 20 hours in an Air Bomb at 260°F and 80 PSI				
35	640	730 (99%)	320 (80%)	–
U. L. Standard	–	75% min.	75% min.	

Naugatuck Chemical

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IMPELLING REASON

for molding precision parts of PLIOVIC

Heart of a problem for manufacturers of a unique, positive displacement, rotary pump was its elastomeric impeller. In trial units its volume increased some 2%, through absorption of water. High operating pressures plus frictional heat caused further dimensional expansion. As a result, the pump, precision-made to clearances of 0.002" to 0.003", often became inoperative.

In an attempt to free the situation, the all-nitrile-rubber compound was abandoned. New compounds based on polyvinyl chloride resins were tried. After many tests with many resins, it was found that PLIOVIC – the easy processing vinyl – when plasticized with the original rubber, gave the lowest water absorption – 0.1% or less. Extensive field trials then proved the PLIOVIC-rubber impeller was extremely smooth-working and virtually indestructible.

Moreover, production workers found that high density PLIOVIC was easier handled, blended more rapidly and thoroughly with the rubber and gave consistently faithful reproduction of the mold. The sum total was a finer product at a cost lower than that possible with other resins.

The particular PLIOVIC used in the impeller compound is one of a family designed to help you to new or improved products, easily and economically. Each of these resins is carefully controlled as to its particle size, shape and distribution to give you maximum ease of processing without sacrifice of desired physical properties. For details, samples and full technical help on which PLIOVIC is best suited to your needs, just write to: Goodyear, Chemical Division, Akron 16, Ohio.

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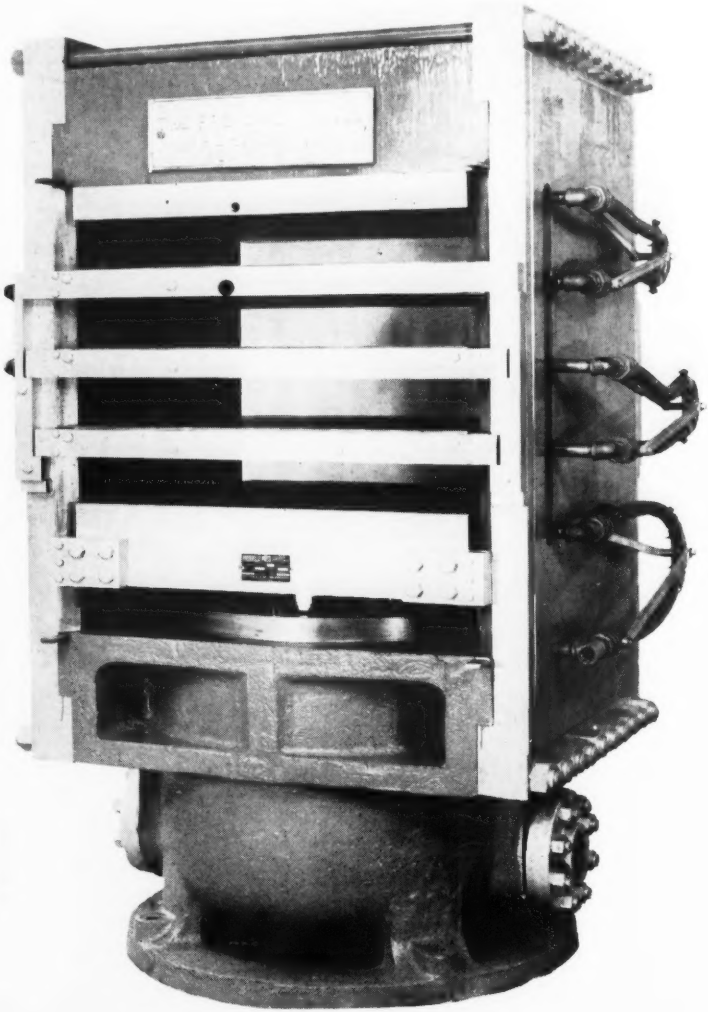

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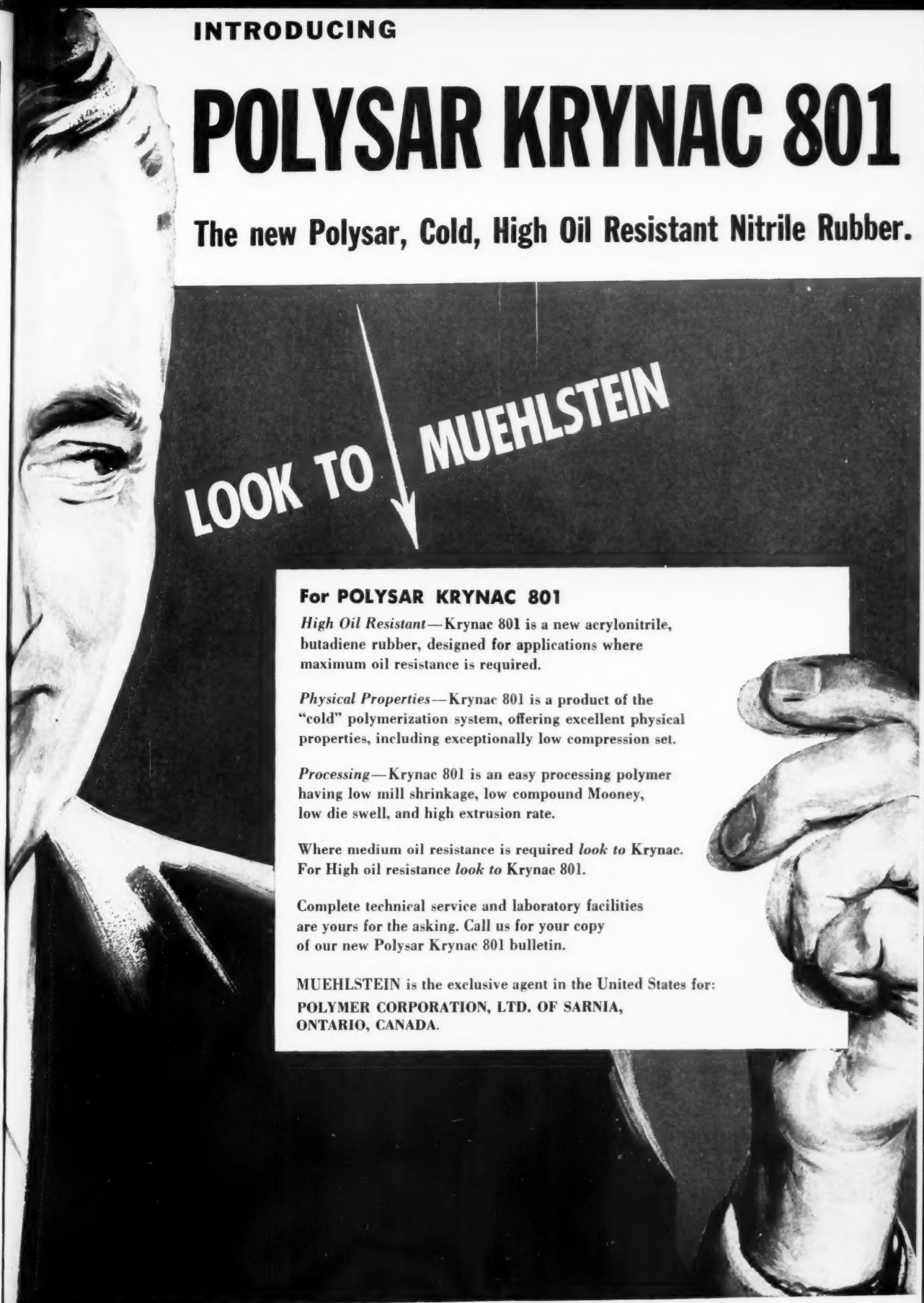
POLYSAR KRYNAC 801

The new Polysar, Cold, High Oil Resistant Nitrile Rubber.



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High Oil Resistant—Krynac 801 is a new acrylonitrile, butadiene rubber, designed for applications where maximum oil resistance is required.

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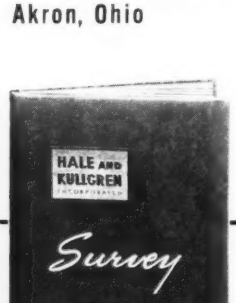
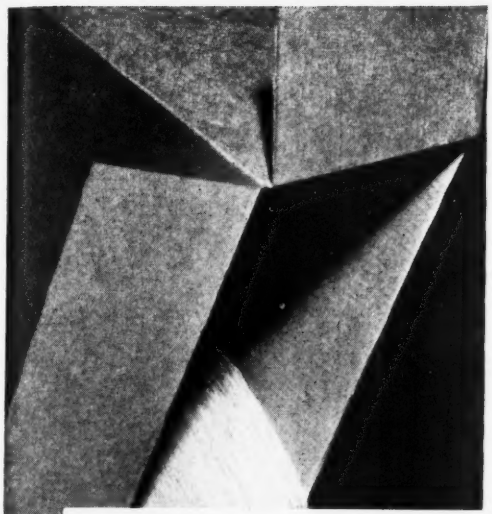


Program for Profits



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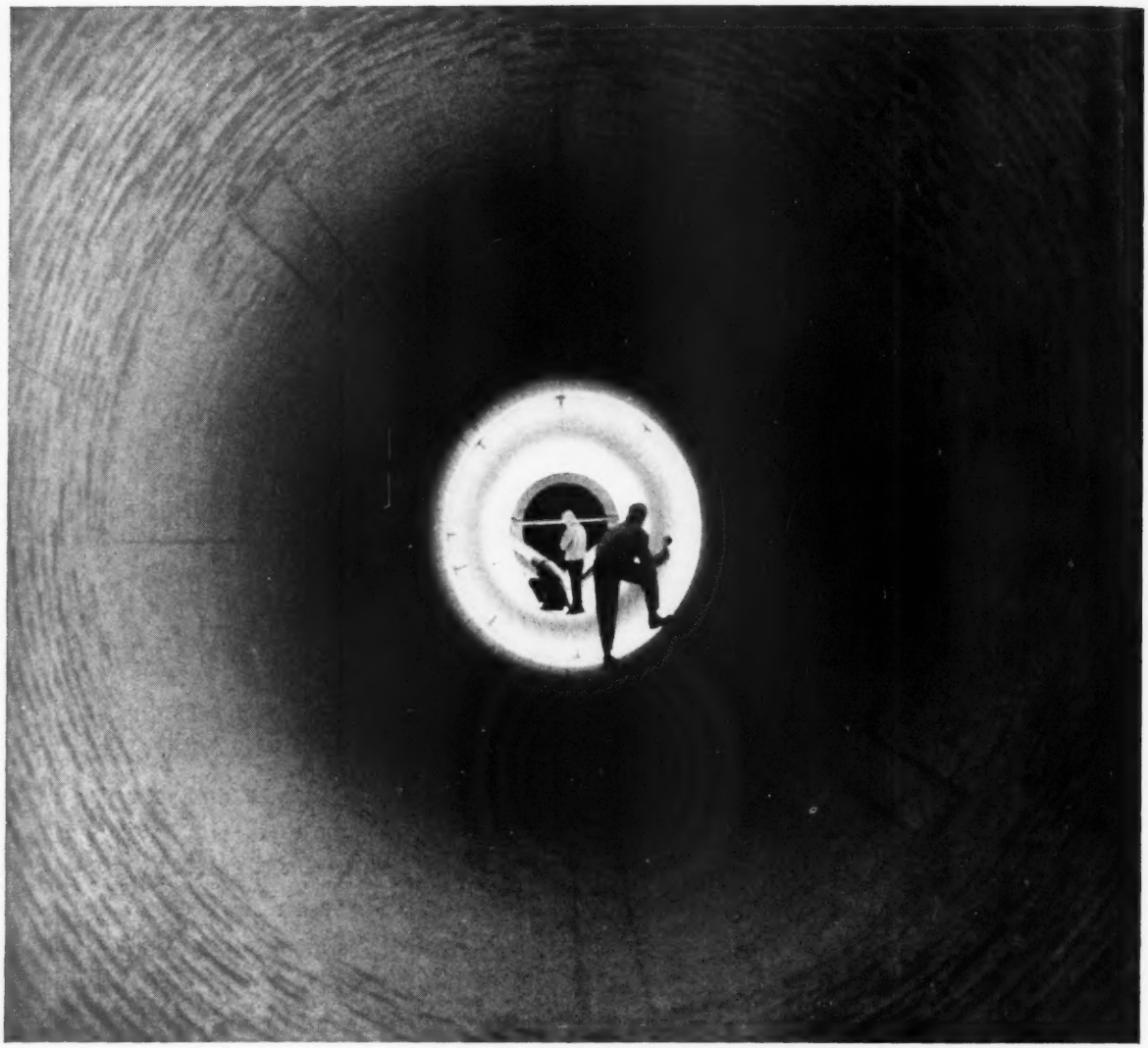

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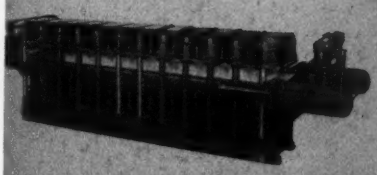

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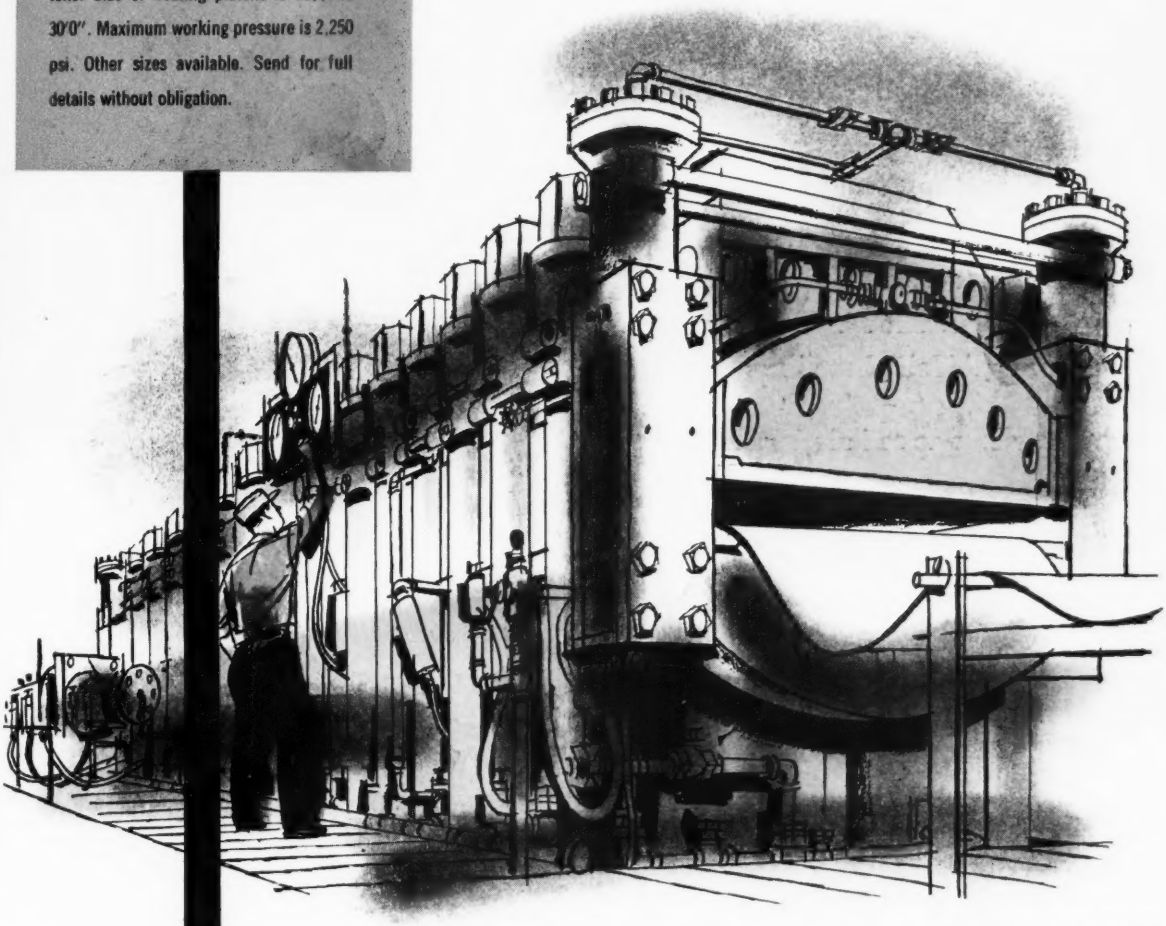

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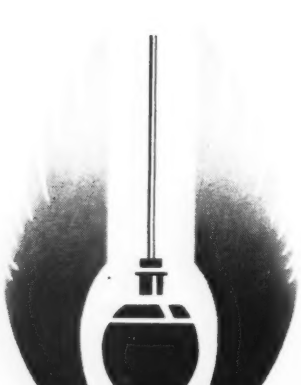

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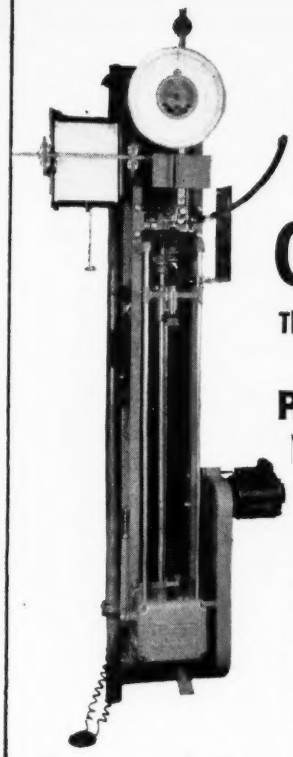

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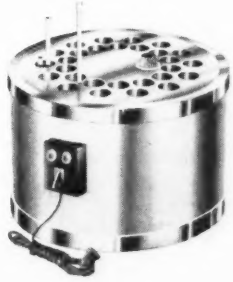

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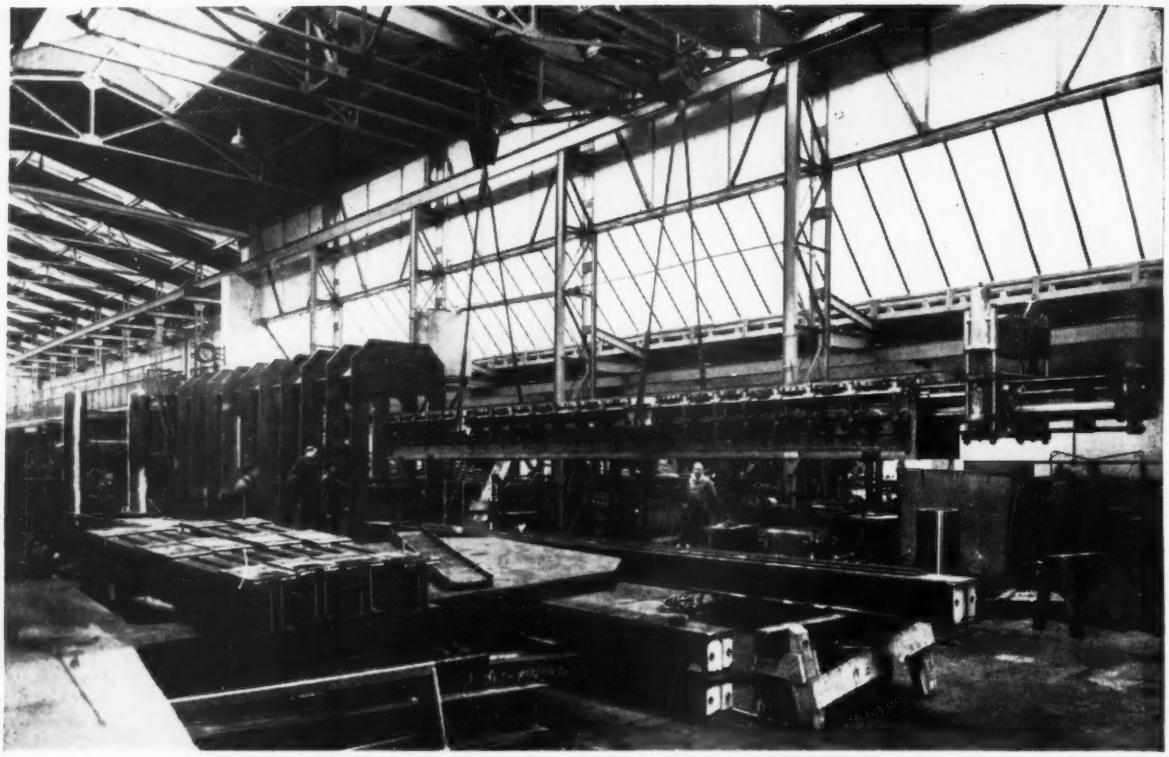
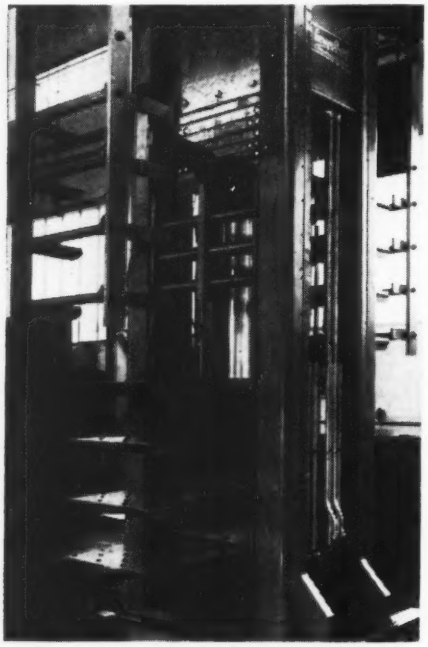


Assembly of one of the larger presses for making conveyor belts and matting.



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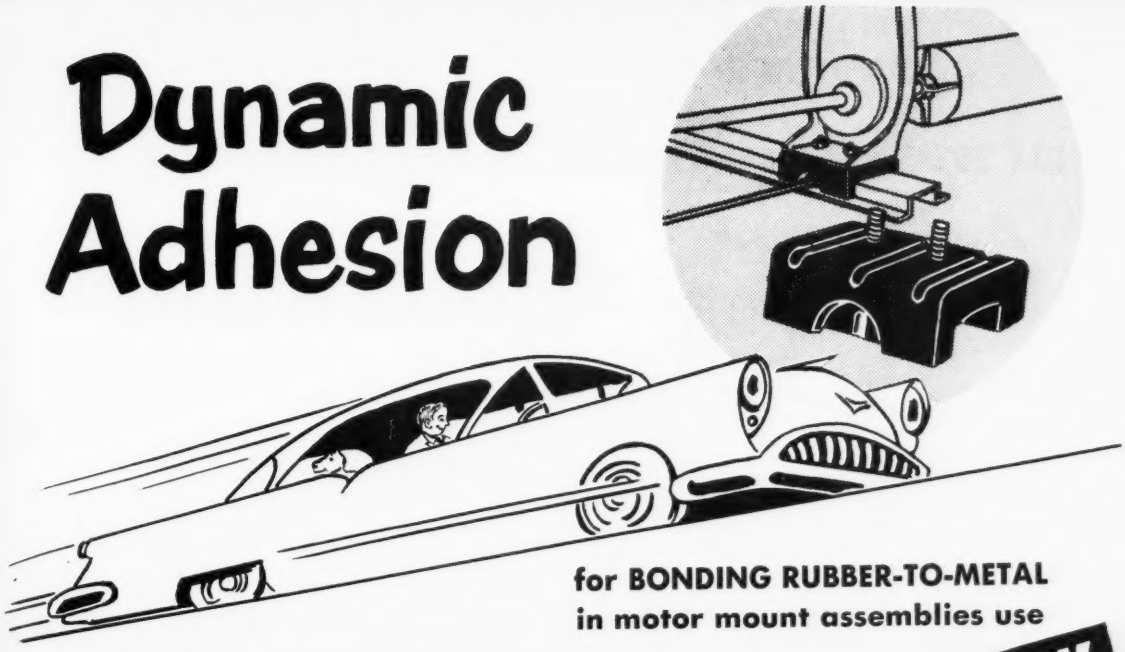

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TY-PLY "UP" . . . the new Universal Primer and TY-PLY "RC" . . . the improved Rubber Cover Cement are exceptionally suitable for natural rubber stocks (both normal and low-sulfur), standard and cold-polymerized GR-S's, polybutadiene, oil-modified GR-S, arctic-type GR-S and natural-GR-S blends. Both adhesives have excellent shelf and working stability; are insensitive to weather or ozone conditions; and work well over a wide range of curing temperatures.

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TY-PLY has stood the test of time . . . since '39

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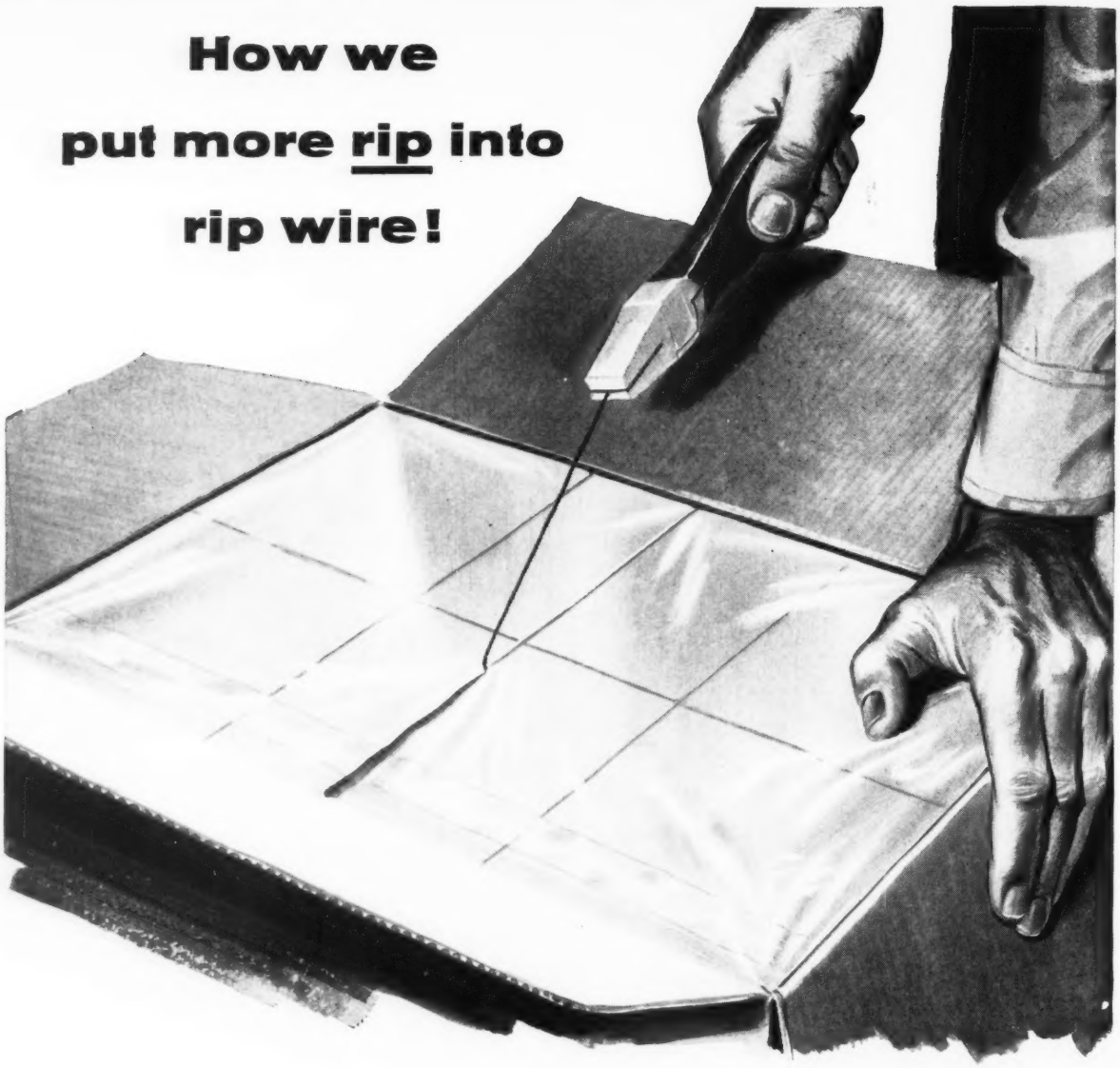

● Industry often wraps its products in heavy paper to protect it from damage due to moisture, handling and other causes. To make these packages or bundles easier to open, *Worcester Wire Works* has developed a special rip wire for inclusion in the wrapping.

To get even greater protection, some products are wrapped in plastics rather than paper. And this caused a problem. Ordinary rip wire wouldn't cut the tough plastic.

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Not all of the problems we solve for industry have such simple solutions. Often, we are called upon to develop steel and wire with completely new characteristics . . . to combine seemingly incompatible factors or properties. And quite frequently these are developments that other manufacturers have given up on.

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Use

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Specify UNITED BLACKS

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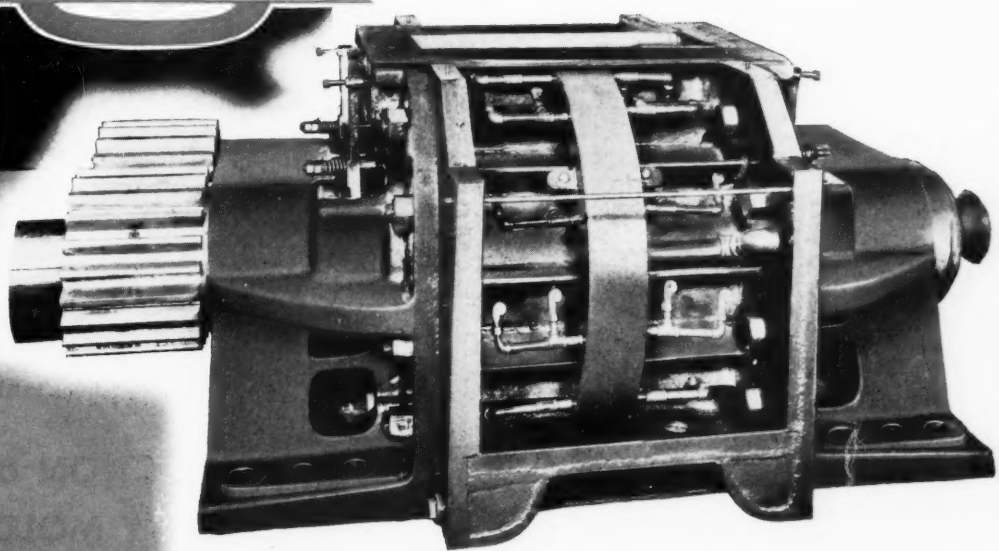
A SECO REBUILT BANBURY

ESTABLISHED 1868



guarantees

new

equipment

performance

A SECO ESTABLISHED 1868 rebuilt Banbury is backed by the twenty-one years' specialized Banbury rebuilding experience of Interstate Welding Service,* combined with Skinner Engine Company's 86-year history of high-precision machining in the heavy goods industry—your guaranty of the finest of engineering and workmanship.

Rotors, side jackets, rings, bearings, end frames, thrust nuts, door tops, connecting gears—all are carefully examined by skilled technicians and magnafluxed to detect hidden defects. Each worn part is either replaced by a new part or is restored to its original size and contour. All wearing surfaces are thoroughly hard surfaced.

When your Banbury mixer needs repairing or rebuilding, give us a call—one of our engineers will visit your plant and inspect your installation—without cost or obligation to you.

INTERCHANGE PLAN: → **For a minimum of down time, investigate our guaranteed interchange plan.**

STOCK PARTS: → **All parts in stock, including bodies, for any size mixer.**

SKINNER · ENGINE · COMPANY

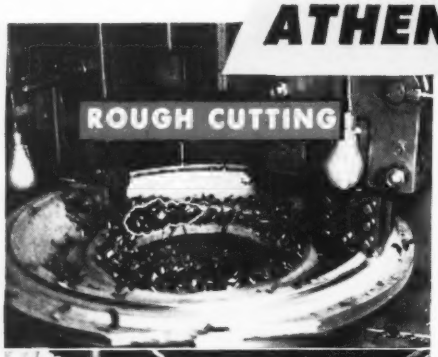
(*) NOW THE RUBBER MACHINERY DIVISION OF SKINNER ENGINE COMPANY.

SECO ESTABLISHED 1868

RUBBER MACHINERY DIVISION
TELEPHONE ERIE 2-3661
ERIE 6 · PENNSYLVANIA

Tire mold making is at its best—

at BRIDGWATER'S *ATHENS MACHINE DIVISION*



In Size, Facilities and Skills, We're Equipped To Serve Your Tire Mold Requirements with

★ FASTER PRODUCTION of
★ HIGHER QUALITY MOLDS at
★ NO PREMIUM IN PRICE

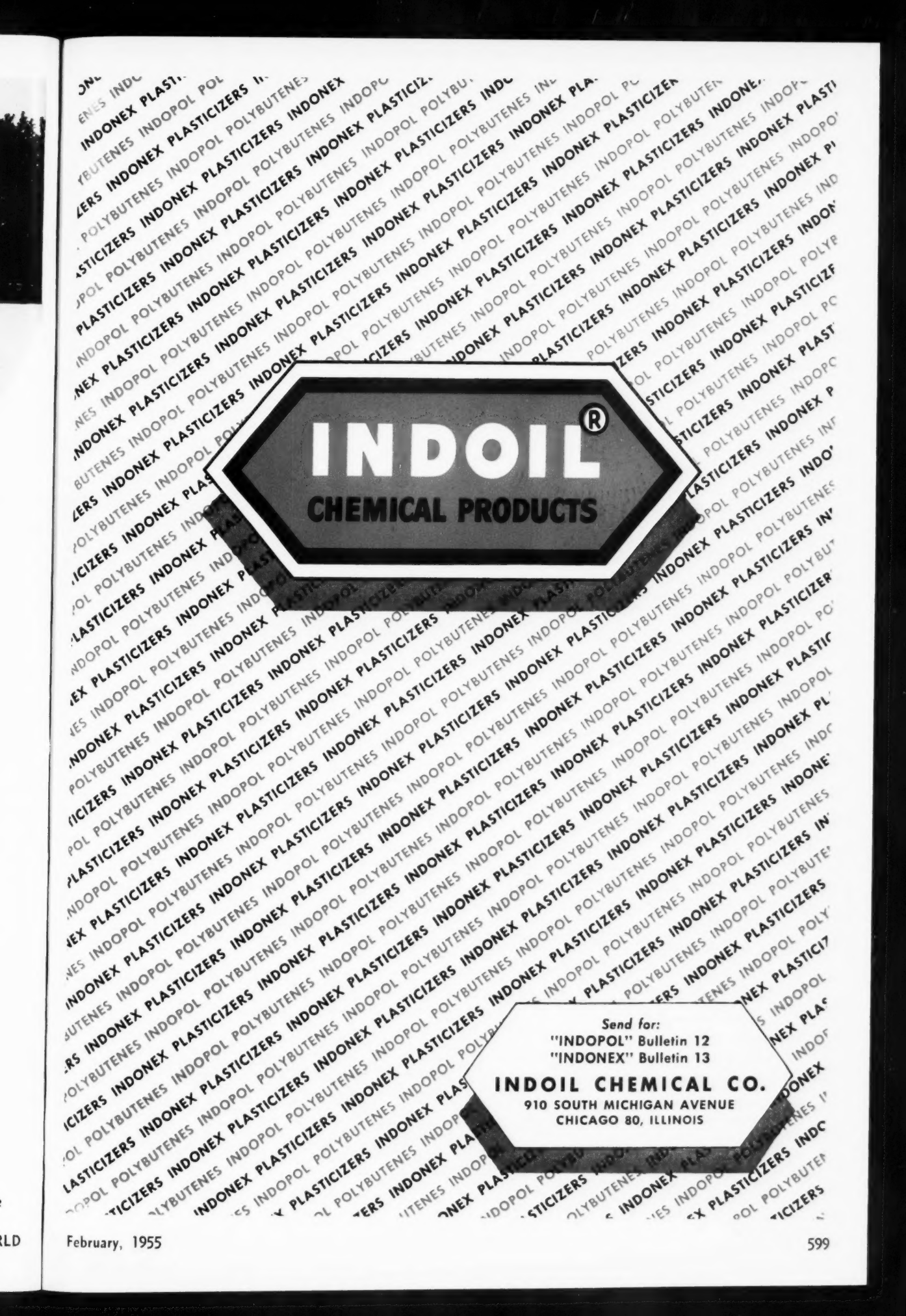
Already the largest plant in the world devoted exclusively to tire mold manufacture, Bridgwater *continues* to expand the facilities and floor space of its Athens Machine Division . . . as often as required to make sure immediate and individual attention can be given to our customers.

At Athens, specialization in the one product enables us to produce highest quality tire molds in engraved steel, cast iron or aluminum — in any type or size — quickly, and at most favorable cost.

Athens Machine Division

BRIDGWATER
MACHINE COMPANY
AKRON, OHIO

1922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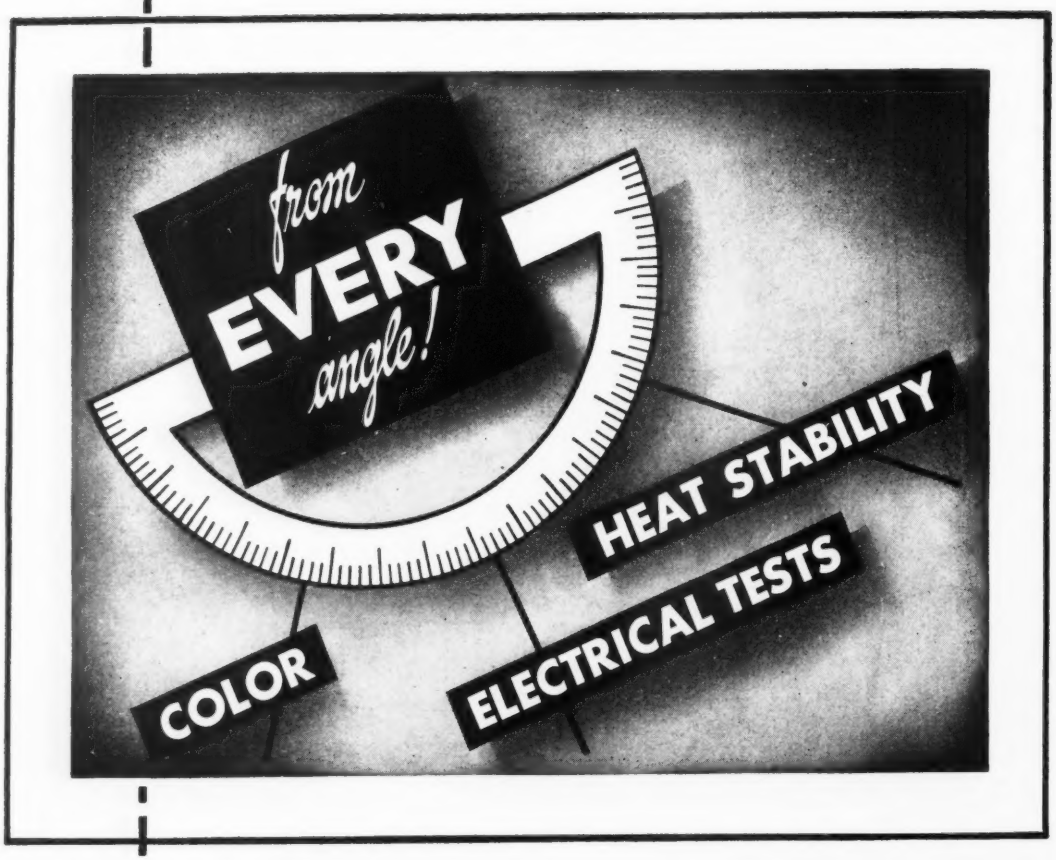
INDOIL CHEMICAL CO.
910 SOUTH MICHIGAN AVENUE
CHICAGO 80, ILLINOIS



PIGMENT NO. 33

for Compounding

VINYLS AND SYNTHETIC RUBBER

Sample and technical data sent promptly on request

SOUTHERN CLAYS, Inc.

33 RECTOR STREET
NEW YORK 6, N. Y.

ANOTHER QUALITY CHEMICAL BY GENERAL TIRE

This Can't Happen with GEN-TAC*

This looks like a bruise break but was caused by moisture entering a puncture. Gen-Tac (Vinyl Pyridine Latex) prevents such failures because its remarkable adhesion persists under the worst possible conditions. Gen-Tac can actually produce adhesion of rubber to Nylon that is greater than the strength of the cord itself.

For samples and reference data write to The General Tire & Rubber Company, Chemical Division, Akron, Ohio.

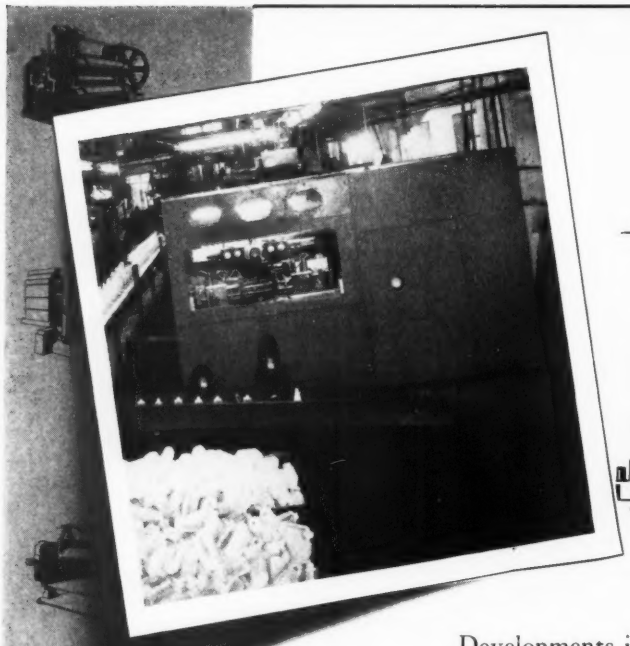
*T. M. G. T. & R. Co.

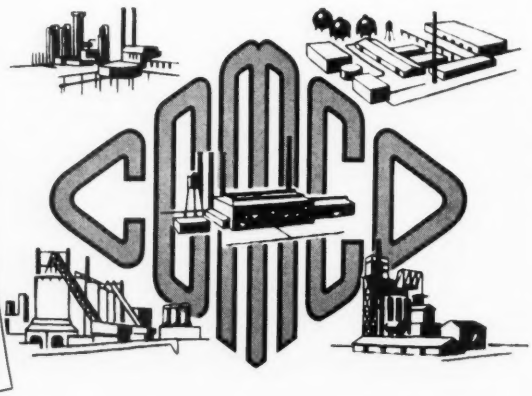
Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO.

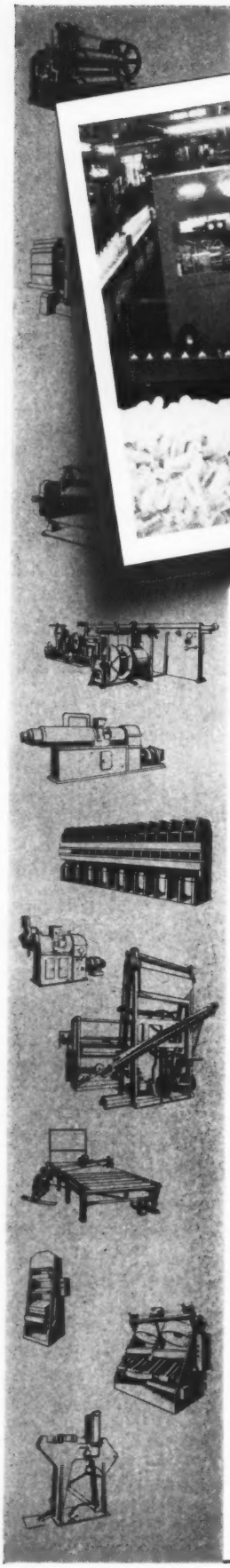
GEN-TAC

Creating Progress Through Chemistry

General Tire also produces . . .
Vygen* (Polyvinyl Chloride) • Gen-Flo* (Paint Latex) • Kure-Blend® (Masterbatch Accelerator) • Ko-Blend® (Insoluble Sulfur Masterbatch) • Glykon* (Polyester Resin) • Polystop® (GRS Shortstop)







Developments in recent years have resulted in commercial bottle making machines using polyethylene materials with production methods based on the extrusion or injection moulding technique combined with the blowing process.

The Shipton Semi-Automatic Machine was designed for the smaller manufacturer who is likely to encounter a large number of medium-sized orders for different types and sizes of bottles.

The machine cycle is arranged to produce two types of bottles simultaneously in all sizes up to 2,300 cm.

The operator can work continuously between the two moulds provided the average wall thickness of the bottle does not exceed approximately 1mm. There is no waiting time for cooling off.

Both the automatic machine, illustrated above, and the semi-automatic machine are self-contained units which need only be connected with electrical and cooling water supplies for immediate production.

If you are in need of a machine or an item of special equipment, if you intend expanding your facilities or plan entering new fields of manufacture, consult us first. We supply all types of machinery and equipment for every requirement of large and small factories.

Integrated Service provides complete design, layout and construction supervision for rubber, plastics and chemical plants, process engineering, technical service and raw material sources.

Continental Machinery Company, Inc.

AND

ASSOCIATED ENGINEERS AND ARCHITECTS

261 BROADWAY, NEW YORK 7, N. Y.

TELEPHONE: WORTH 2-1650 • CABLE: "CONTIMAC" NEW YORK

RELIABLE ZINC OXIDES

AZO-ZZZ-44 and AZO-ZZZ-55 assure good dispersion and easy processing because of their uniform particle size and absence of extreme fines. With AZO-ZZZ-11, 22, 33, (Acicular types) and special grades, a complete range of zinc oxides is offered for every rubber requirement.

A RELIABLE SOURCE

American Zinc assures an uninterrupted supply of zinc oxide. Recent discovery and development of a new, large ore body, added to previous American Zinc reserves, provides sufficient ore to last many years at the current rate of production.

AZO **ZZZ-44**
ZZZ-55

AMERICAN ZINC SALES COMPANY

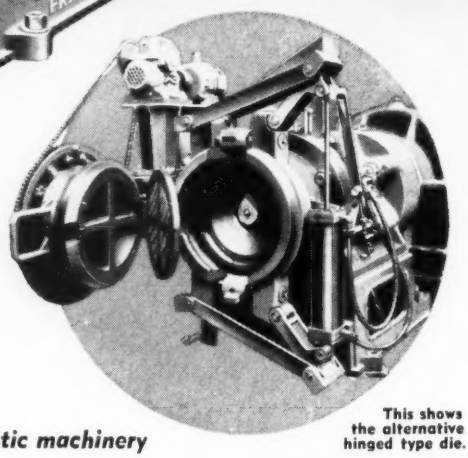
distributors for

AMERICAN ZINC, LEAD & SMELTING COMPANY

COLUMBUS, OHIO • CHICAGO • ST. LOUIS • NEW YORK

for efficient straining of raw rubber, mixed stock and reclaim

Shaw heavy duty strainers are designed for the straining of raw rubber, mixed stocks, reclaim etc., and are available with screws of 6″, 8″ or 10″ diameter. The straining head is of the end delivery type arranged on sliding bars, and the locking and unlocking gear is hydraulically operated by means of a self-contained motor-driven pump. We shall be pleased to forward an illustrated leaflet describing these machines in detail.



This shows the alternative hinged type die.

Industry's headquarters for the best in Rubber and Plastic machinery

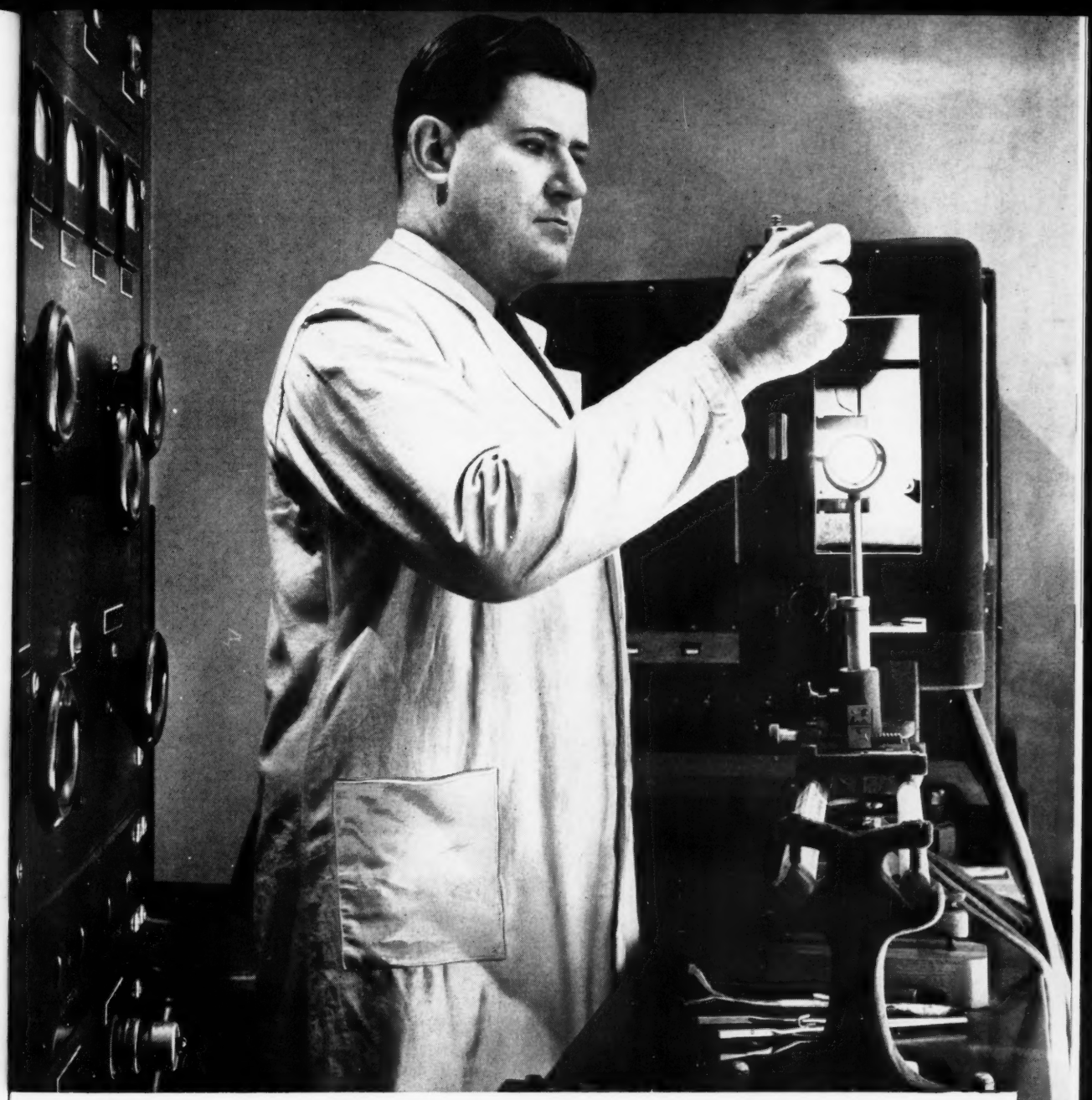
SHAW HEAVY DUTY STRAINERS

FRANCIS SHAW & CO., LTD. MANCHESTER 11, ENGLAND

TELEPHONE: EAST 1415/8. TELEGRAMS: CALENDER MANCHESTER

LONDON OFFICE: 34 VICTORIA STREET, LONDON SW1. PHONE: ABBEY 5077/8. GRAMS VIBRATE PHONE LONDON

FRANCIS SHAW (CANADA) LTD., GRAHAMS LANE, BURLINGTON, ONTARIO, CANADA



Portraits of impurities-taken 32 times faster!

Impurities in pigments are now measured in the Glidden laboratories in one hour on the emission spectrograph, as compared with the three or four days it required through chemical analysis. Here is another example of how Glidden uses every modern means to insure uniformity and outstanding quality in its pigments. The time saved permits research technicians to devote more hours to other important quality control projects which insure you of the finest in ZOPAQUE Titanium Dioxides; CADMOLITH Reds and Yellows; or SUNOLITH Lithopones.

THE GLIDDEN COMPANY

Chemicals • Pigments • Metals Division

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CHEMICALS
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Glidden
PRODUCTS

Order a shipment of

WITCO-CONTINENTAL

CARBON BLACK

on expendable pallets

WITCO

35 Years of Growth

WITCO CHEMICAL COMPANY

CONTINENTAL CARBON COMPANY

260 Madison Avenue, New York 16, N. Y.

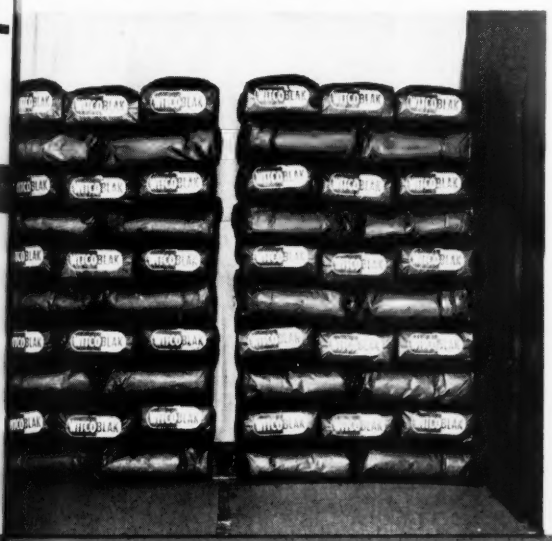
CHICAGO • BOSTON • CLEVELAND • AKRON • ATLANTA • HOUSTON • AMARILLO • LOS ANGELES

SAN FRANCISCO • LONDON AND MANCHESTER, ENGLAND

Witco-Continental pioneered palletized carbon black shipments.

Shipped by rail or truck, palletizing saves you time and money in carbon black handling.

Palletized shipments are loaded and unloaded in minutes rather than hours. Engineered stacking patterns assure smooth riding, optimum freight rates and undamaged delivery.



Palletized loads can be picked up, carried and placed, all by fork lift truck. Load lock adhesive on each bag keeps stacks firm and neat, increases handling safety and speed.

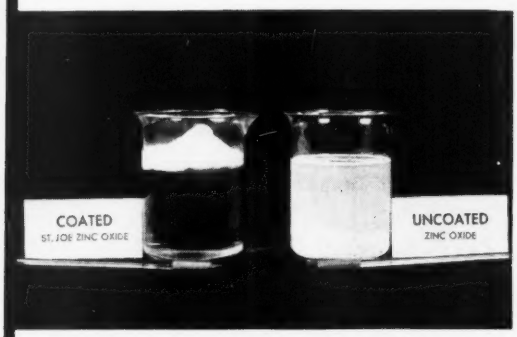
Palletized loads can be stacked in your warehouse, two-high, with ease. You save valuable storage space and materials-handling manpower. Order from Witco-Continental today and save.

Witco—Continental packaging and materials-handling engineers are available for consultation on any specific problem in the further development of materials-handling technique.

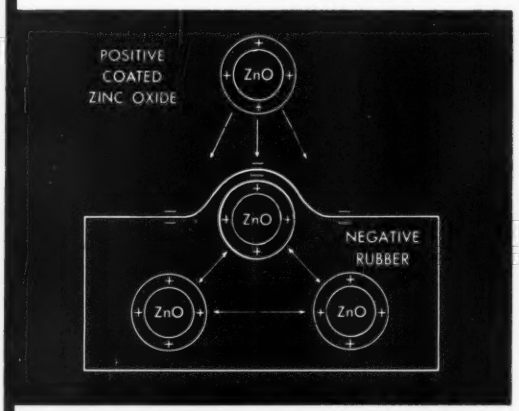
FROM **8** TO

85 CUSTOMERS

IN **5** YEARS



above: Graphic illustration of the hydrophobic nature of the surface treatment given all St. Joe coated Zinc Oxides which indefinitely resist wetting when placed in contact with water. This unique property of St. Joe coated Zinc Oxides guarantees to the consumer maximum resistance to moisture absorption during storage.



above: The monomolecular film or hydrophobic, high molecular weight organic ester on St. Joe's coated Zinc Oxide has a more positive charge than that of rubber. Thus, the rubber has a greater affinity for St. Joe's coated Zinc Oxide than for uncoated pigment with consequent reduction in incorporation time. The repelling force of the positively charged film on the zinc oxide particles themselves gives improved dispersion in less time by preventing agglomeration.

that's the success story of

ST. JOE coated ZnO

ST. JOSEPH LEAD COMPANY
ST. JOE ZINC OXIDE
JOSEPHTOWN, PA.

BLACK LABEL #20-21
Fine Particle Size

GREEN LABEL #42-21
Medium Particle Size

Do what 85 other rubber manufacturers have done—make a factory test and prove to yourself these advantages of St. Joe coated Zinc Oxides:

1. Moisture resistant
2. Faster incorporation
3. Better dispersion
4. Increased mixing capacity
5. Lower power consumption
6. Lower mixing temperature
7. Reduced storage space

note: All St. Joe Zinc Oxides may now be shipped as space-saving Unit-Loads. Our 6-page illustrated folder, containing detailed operating data on the St. Joe Unit-Load method is yours for the asking.

ST. JOSEPH LEAD COMPANY
250 Park Avenue, New York 17
Plant & Laboratory: Monaca (Josephtown) Pa.

SILICONE EMULSION

HSC-35

A BETTER MOLD RELEASE AGENT *and* LUBRICANT THAT SAVES TIME *and* CUTS PRODUCTION COSTS

- ✔ ON TIRE MOLDS AND CARCASSES
- ✔ IN CURING BAG DIP TANKS
- ✔ ON MOLDS FOR MECHANICAL GOODS
- ✔ ON RUBBER SOLES AND HEELS
- ✔ ON VINYL FLOOR TILES
- ✔ ON HIGH-LOADED THERMOSETTING COMPOUNDS
- ✔ ON SHALLOW-DRAW MOLDS WITH ALL TYPES OF COMPOUNDS

HSC-35 is a 35% oil-in-water emulsion of Silicone Mold Release Oil, developed to assure the most efficient use of the active ingredient . . . As a mold and bag dip lubricant it has proved outstanding as a release agent, keeping molds cleaner and surface-finish of products free from deposit or stains . . . HSC-35 possesses unusual stability to "creaming" and phase separation . . . It is being used with remarkable success on all types of molds for mechanical goods, soles and heels, on mandrels and under extruded lead, on vinyl tile presses, in the treatment of cloth and paper used for polishing and in the treatment of glass fibers to render them water-repellent. Many other successful applications establish the broad versatility, economy and efficiency of HSC-35.

**Write for complete data.*

HARWICK STANDARD CHEMICAL CO.

AKRON, BOSTON, TRENTON, CHICAGO, LOS ANGELES

NOW!

BANBURY® BODIES FA

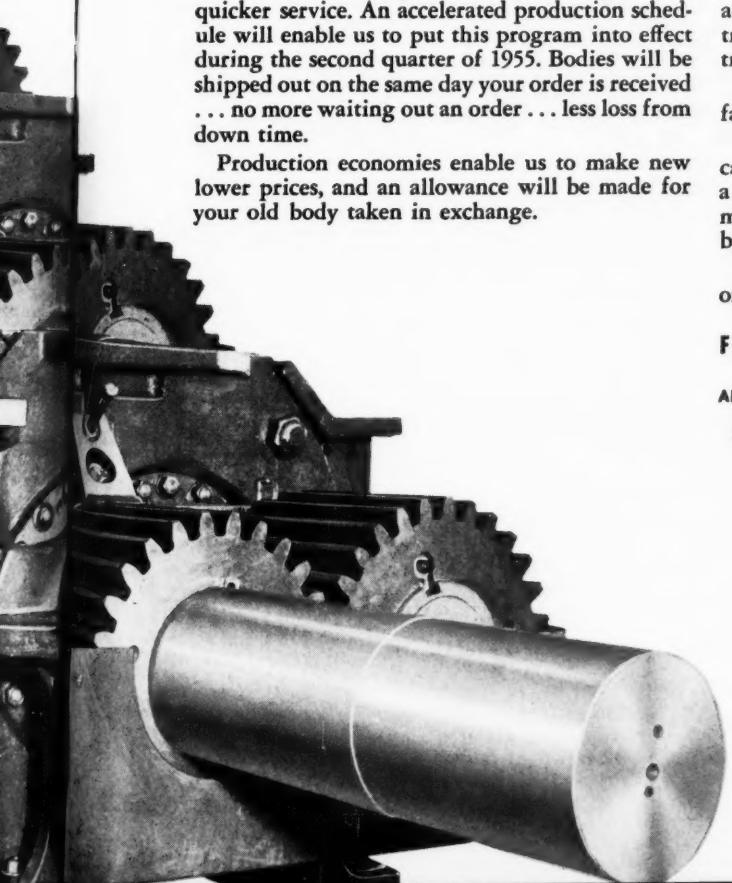
Farrel-Birmingham®

IES FASTER...AT LOWER COST

Quick delivery— from Buffalo for Western points Derby for Eastern points

We are preparing to stock a large number of new and rebuilt Banbury mixer bodies to give you quicker service. An accelerated production schedule will enable us to put this program into effect during the second quarter of 1955. Bodies will be shipped out on the same day your order is received . . . no more waiting out an order . . . less loss from down time.

Production economies enable us to make new lower prices, and an allowance will be made for your old body taken in exchange.



We chose our Buffalo plant for service to western points, because it is within 200 miles of Akron, and it is large and well equipped. It is a good central point for shipment to any points west—by rail, truck or water.

Our Derby plant will be heavily stocked for fast service to eastern points.

Banbury bodies rebuilt by Farrel-Birmingham carry the same guarantee as our new bodies. Such a guarantee by the manufacturer of the Banbury mixer provides assurance that the rebuilt body will be "as good as new" when it goes back into service.

For further details, write, wire or phone the office nearest you.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONN., (Ansonia, REgent 4-3331)
AKRON, OHIO, 2710 First National Tower (POrtage 2-8871)
CHICAGO, ILLINOIS, 120 So. LaSalle St. (ANdover 3-6434)
LOS ANGELES, CALIF., 2032 Santa Fe Ave. (Lafayette 3017)
HOUSTON, TEXAS, 860A M & M Building (Capitol 6242)

FB-979

Bloom PROBLEMS?

Stauffer CHEMICALS SINCE 1885

CRYSTEX 85% Insoluble Sulphur

CAN SOLVE THEM AND:

1. improve product quality and appearance

Crystex, because of its high insolubility in rubber, cannot migrate and "bloom" like ordinary sulphur in your rubber compounds. This assures better surface appearance, particularly important in white side-walls and other light colored consumer goods in which "yellow spots" would be objectionable.

By preventing bloom, Crystex improves the tack of built-up stocks such as tire carcasses, belting, and valve patch frictions, thereby guaranteeing good adhesion after vulcanization.

2. save on plant operation costs

A stock blended with Crystex can be kept for long periods before vulcanization without the danger of blooming. Mixing and vulcanization schedules can be made more flexible to permit maximum utilization of machinery and labor without the worry of a "time element" imposed by the danger of bloom.

3. increase compounding flexibility

Formulating with Crystex will allow variations to be made in factory recipes that tend to be "scorchy"; its use will control the degree of tackiness of factory stocks. The unusual characteristic of being insoluble in "anything and everything" except more sulphur may suggest additional uses in your formulations.

Enthusiastic acceptance of Stauffer CRYSTEX by the rubber industry has necessitated the construction of a new plant, and CRYSTEX is now produced at both Chauncey, N.Y., and Monongahela, Pa. Packed in 50-pound multiwall paper bags, Stauffer CRYSTEX is available in all quantities up to car-load.

Write for experimental samples or further information on the properties and uses of CRYSTEX.

STAUFFER CHEMICAL COMPANY

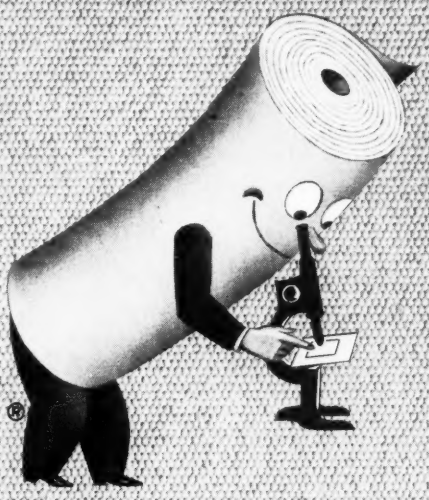
380 MADISON AVENUE, NEW YORK 17, N. Y.

221 N. LaSalle St., Chicago 1, Ill. • 636 California St., San Francisco 8, California
326 S. Main Street, Akron 8, Ohio • 824 Wilshire Boulevard, Los Angeles 14, Calif. • 8901 Hempstead Road, Houston 8, Texas • North Portland, Ore. • Weslaco, Texas • Apopka, Fla.

UNIFORMITY

Makes The Big Difference In

INDUSTRIAL FABRICS



MT. VERNON FABRICS

Give You Greater Uniformity

FABRICS ENGINEERED TO FIT YOUR NEEDS – Need adaptation of an existing fabric to your special purposes? Or creation of an entirely NEW fabric – cotton, synthetic or blend – to meet your specifications? Mt. Vernon-Woodberry's staff of textile engineers is available on request to help you with your problems in development or application of industrial fabrics.

Mt. Vernon-Woodberry Mills

TURNER HALSEY COMPANY
Selling Agents

Main Office: 40 Worth St. • New York

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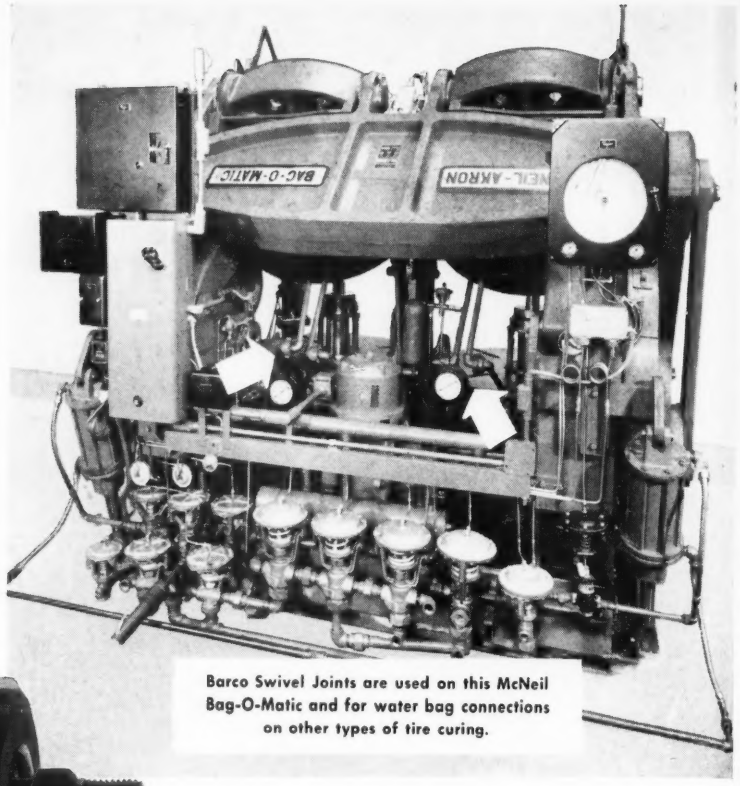
One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products. Here fabric thickness after weaving is being gauged.

Improved BARCO *Swivel* JOINTS



Barco Swivel Joints are used on this McNeil Bag-O-Matic and for water bag connections on other types of tire curing.

GET THIS BULLETIN!

IT'S easy to get the right answer for even your most special steam, air, or hydraulic *piping jobs* when you use this new engineering catalog on BARCO SWIVEL JOINTS. It is complete with pictures and diagrams showing correct application and contains all specification data for *improved* Barco Swivel Joints:

- Leakproof! Perfect Sealing—Hot or Cold.
- No Binding, Low Torque! Trouble-free.
- Self-Aligning! Simplifies Installation.
- No Lubrication Required! Easy Maintenance.
- Economical! Wide Choice of Sizes and Styles.

SEND FOR A COPY OF NEW CATALOG NO. 265A AND INSTALLATION DRAWING 10-52004

Used by Leading Machine Builders!

FOR TIRE MOLDS, PLATEN PRESSES

DEPENDABLE, TROUBLE-FREE PERFORMANCE — time after time — has been the one big reason for using Barco Swivel Joints in flexible piping connections and dog-legs on tire molds and platen presses used in the rubber industry. And now Barco offers even *better* performance and service, not only for new uses, but for thousands of existing installations.

The ANSWER is Barco's new, chemically inert No. 11 CT gasket. No other material is as amazingly long wearing and versatile. Even under most adverse conditions, joints maintain their seal, hot or cold, working or idle — with lower torque and no lubrication required. Natural operating action keeps the hemispherical ball of the joint lapped to a perfect fit.

Get this *advanced performance* in new Barco Swivel Joints! Send for complete information on MODERNIZING old joints!

BARCO *Manufacturing Co.*

510C Hough Street, Barrington, Illinois
In Canada: The Holden Co., Ltd.
The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

STOP CRACKING IN RUBBER—

UOP 88

TRADE MARK

RUBBER
ANTI-OZIDANT

PRODUCTS DEPARTMENT

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILL., U. S. A.

In Your Latex Compounds . . .

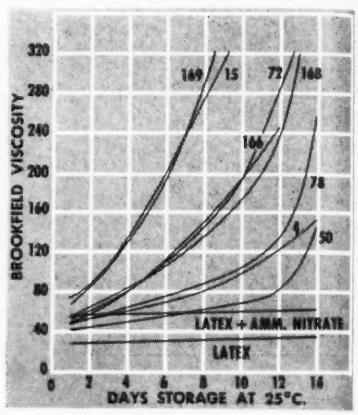
WHICH HORSE HEAD ZINC OXIDE DO YOU NEED?

Most formulators agree that zinc oxide is the most critical ingredient to select for latex use.

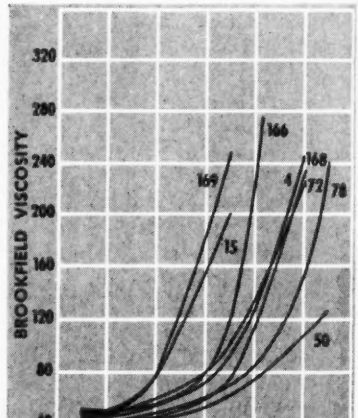
Here's why:

1. YOU can choose from many types of zinc oxides, and each type influences such important properties of latex compounds as viscosity, suspension, stability, rate of gelation and rate of cure.
2. YOU can't predict the influence of any type of zinc oxide on the properties of your latex compound . . . because the influence of a zinc oxide depends upon the specific latex formulation, as shown in the charts at right.

So . . . for best results, test the widest range of types—the Horse Head family—including the exclusive Kadox and Protox* brands.



Influence of zinc oxides on the chemical stability of latex containing 1% NH_4NO_3



Influence of zinc oxides on the chemical stability of latex containing 1% $(NH_4)_2SO_4$.

HORSE HEAD ZINC OXIDES FOR LATEX

Brand	Surface Area (Sq. M /Gm.)	Process of Mfg. American	Process of Mfg. French	Propionic Acid Surface Treatment
XX-50	3.0	✓		
XX-78	3.9		✓	
XX-4	4.4	✓		
Protox–166	4.4	✓		✓
Kadox–72	7.9		✓	
Protox–168	7.9		✓	✓
Kadox–15	10.0		✓	
Protox–169	10.0		✓	✓

*U. S. Patents 2,303,329 and 2,303,330

THE NEW JERSEY ZINC COMPANY

Producers of Horse Head Zinc Pigments

. . . most used by rubber manufacturers since 1852

160 Front Street, New York 38, N. Y.

HORSE HEAD PRODUCTS

Pyratex

a new cord treatment for new tire toughness!

Naugatuck – developer of the first natural latex for tire cord treatment, then the first reclaim dispersion, and later GR-S plus Resorcinal – now offers you a special vinyl pyridine latex that increases rubber-to-fabric adhesion up to 50%!

New Pyratex

- binds rayon to rubber with a grip almost as strong as the cord itself.
- retains its outstanding adhesion even under the severe heat and flexing of high-speed tire travel.

What's more, this superior solutioning agent . . .

- develops adhesion more rapidly with cure.
- greatly reduces "curing blows."
- is supplied at higher solids with resulting conveniences.

You'll find Pyratex will raise the performance of reinforced rubber in airplane, truck, bus, and automobile tires, in V-belts and conveyor belts—*wherever* fatigue resistance and ply separation pose problems.

New Pyratex is available for your own further compounding, or as a **Lotol, custom-compounded and ready to use—with good storage stability.** To find out more about how it can help your product—economically—write on your letterhead to the address below.

NAUGATUCK

Division of United States Rubber Company
Naugatuck, Connecticut

US RUBBER

BRANCHES: Akron • Boston • Charlotte • Chicago • Los Angeles • Memphis • New York • Philadelphia • IN CANADA: Naugatuck Chemicals, Elmira, Ontario
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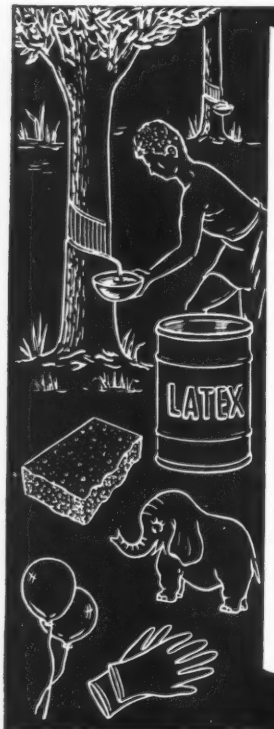

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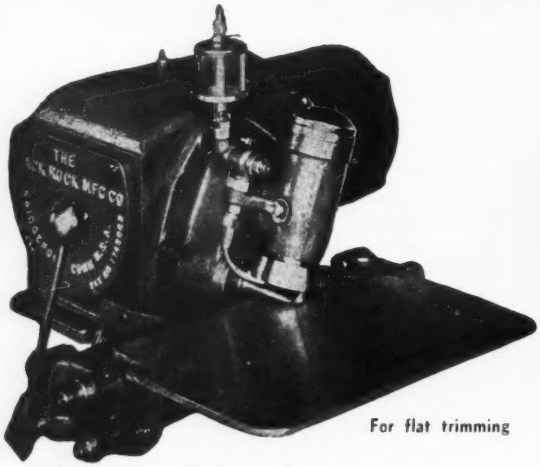

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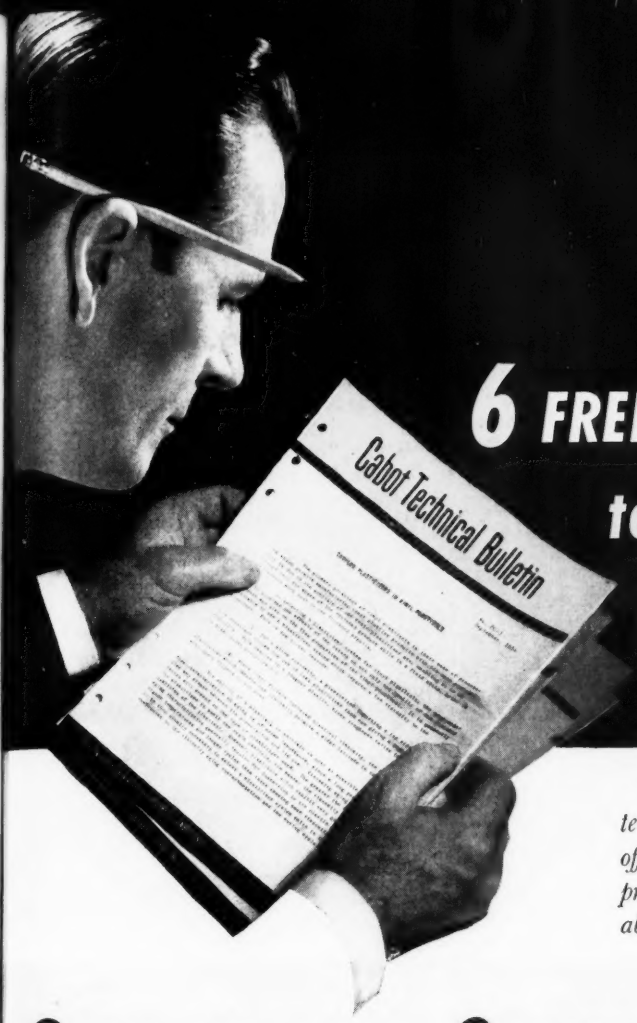

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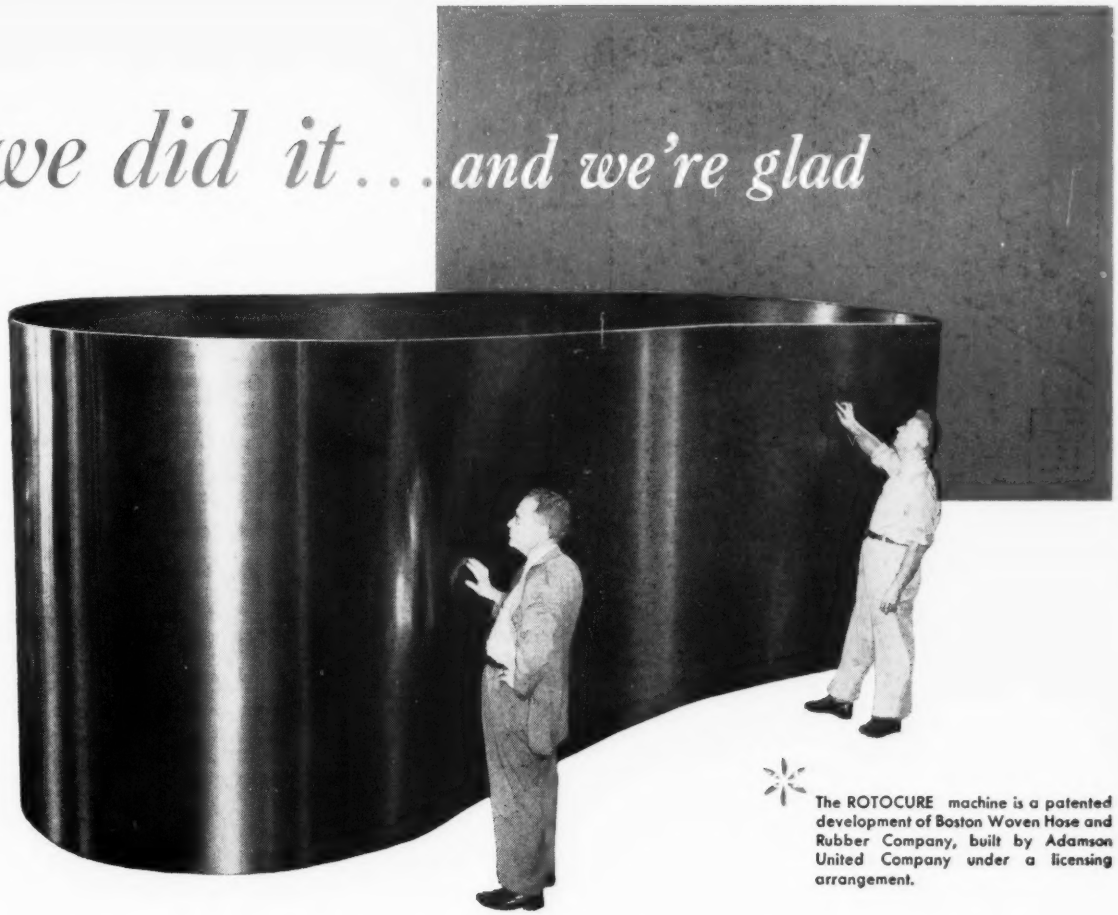

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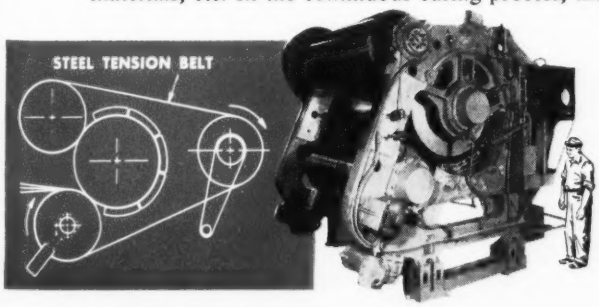

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RUBBER WORLD

FEBRUARY, 1955

Determination of Relative Road Wear Ratings of Tire Tread Stocks—I[1]

By F. H. Amon and E. M. Dannenberg

Godfrey L. Cabot, Inc., Boston, Mass.

The work described in this paper (which will appear in two or more installments) was done primarily to establish and control the road wearing qualities of various grades of carbon blacks in tire treads.

It has also furnished other information of general interest in the field of the road testing of tires, however, as follows: (1) The use of statistical analysis including variance analysis to aid the interpretation of tire test data. (2) Whole tread *versus* two-way tread construction for tire testing. (3) Weight *versus* depth measurements for determination of the rate of wear of tire treads. (4) Evaluation of the relative road wear ratings of natural and synthetic rubber tread compounds containing various grades of carbon blacks. (5) The effect of the rate of wear on relative tread wear ratings.

The first installment contained in this issue includes a determination of the testing error of test designs using two-way treads. This error is compared with the testing error of test designs using whole treads (determined in work to be reported in a later installment). It is indicated that the use of two-way treads is five times more satisfactory than the use of whole tire treads for most road testing programs.

It is also indicated in this first installment that the HAF and MPC blacks tested were significantly poorer than the ISAF black control, as far as the particular compounds and mixes used in the construction of the test tires involved in this work were concerned.

The determination of the wearing qualities of pneumatic tire treads is a problem which not only concerns the manufacturers of tires but also the suppliers of raw materials to the rubber industry. The two most important components of tire tread compounds are rubber and carbon black.

It has been stated by Mandel, Steel, and Stiehler (1)[2] that the effects of the type of rubber and the type of carbon black on the wearing properties of tire treads are independent of each other. If this conclusion were generally valid, it would, of course, considerably simplify the problem of evaluating both different types of rubbers and carbon blacks for tire tread service.

It has been demonstrated (1-3), however, that the relative wearing performance of rubbers and blacks cannot be expressed as a single value, but changes with different service conditions during road testing. Buist, Newton, and Thornley (3) have actually shown reversals in the road wear ratings of two tire treads containing two different loadings of carbon black when compared under road test conditions varying in service severity.

The effect of service severity may also be dependent on the particular factors described by this all-inclusive term, i.e., ambient temperature, abrasive character of road surface, vehicle speed, tire inflation and load, and mechanical condition of vehicle. In addition to the severity of service complication in attempting to rate the road wearing qualities of blacks and rubbers, the problem is further complicated by other factors, such as differences in compounding, processing, tire construction, tire size, and tread design.

The assessment of road wear performance has generally been obtained by testing tread compositions and tire constructions under highly controlled road testing conditions on the same or similar vehicles. It is recognized that the results of such limited testing are not generally applicable to the wide range of service conditions which tires in consumer use actually undergo. Although this factor seriously limits the

[1] Presented at the September, 1954, meeting of the Division of Rubber Chemistry, American Chemical Society, New York, N. Y.

[2] Numbers in parentheses refer to Bibliography items at end of this installment.

value of road testing information, there is no question as to the necessity of such tests in the development of improved tires, better compounds, rubbers, and carbon blacks.

During the last five years various methods and techniques of road testing tires have been described in the literature (1, 3, 4-11). The work of Stiehler and his collaborators (1, 8-10) has emphasized the improvement in precision and reliability of whole tire road tests obtained by employing statistical designs and analysis of results, measurement of wear by weight loss rather than the more conventional depth loss method, and the use of geometric averages of rates of wear instead of the usual arithmetic averages.

The tests described were run with relatively large numbers of tires on a number of vehicles run together in a convoy. For most of these vehicles there were relatively large differences in rate of wear for the various wheel positions, which made it essential that geometric averages be used. Stiehler (10) has pointed out that, in ordinary passenger-car tests where variation in rate of wear on different wheels is not large, there is no particular advantage to the use of geometric averages.

The differences in relative tread wear ratings between the two methods of averaging rates of wear may be as much as a few per cent. for the passenger vehicle used in our tests, assuming reasonable period-to-period wear factor variations. Even so, if at all practicable, it is highly desirable, in view of the high costs of running road tests, to make measurements after each wheel position change in order to establish wheel position wear factors and minimize the possible bias in the averages of the rates of wear.

Buist, Newton, and Thornley (3) have described road tests using tires with two-part and three-part tread constructions. Their tests were run in what might be considered the conventional manner in that four tires were placed on a vehicle, and four wheel position changes were made in a systematic manner to complete a "cycle" or "rotation" in which every tire was run in every wheel position for the same number of miles. The "cycles" or "rotations" were then repeated a number of times to complete the road test.

Tire Test Terminology

Road Test Program: A road test program consists of a series of repeated tire tests performed with replicate sets of tires all made at the same time under controlled processing and manufacturing conditions.

Tire Test: Consists of the determination of road wear properties of a set of tires, four or more in number, on the same vehicle. The treads of these tires are made from different compounds to be evaluated.

Whole Tire Test: A test in which the individual test tires are made with a single tread compound.

Two-Way Tire Test: A test in which the tire treads are divided into two parts, each part consisting of a different tread compound.

Rotation: Each tire is run in all four wheel positions for 1,000 miles per position to complete what has been termed in this paper a "rotation" of 4,000 miles. A tire test consists of a number of repeated "rotations." The measurements by depth and weight methods used are made at the completion of each rotation of a test.

An analysis of variance of the wear rate data obtained showed the effects of the three factors involved consisting of tires, rotations, and compounds. It was also possible from the standard deviation of the testing error, determined from the variance analysis, to establish so-called "confidence" limits of the average tread wear ratings. In this manner the presence or absence of significant differences in the average tread wear ratings for the various compounds was shown.

Statistical Terms

Variance: Estimate of the variance of a set of measurements is equal to the mean sum of squares of the difference between the individual measurements and their average value.

$$\hat{V} = \frac{\Sigma_1^N (X_i - \bar{X})^2}{N-1}$$

where N-1 is referred to as "degrees of freedom."

Degrees of Freedom: It is known that a small sample tends to underestimate the variance of a larger sample and that a better estimate of the true variance is obtained by dividing the "sum of squares" by the number of degrees of freedom (N-1). The use of N-1 as the divisor may be explained by considering the variance to be the mean sum of the squares of the independent differences within a measurement set. There is always one less difference in a set than in the number of measurements (e.g., there is but one difference between two divisors).

Standard Deviation: The standard deviation is a measure of the dispersion of a set of measurements. If such a set of measurements has a distribution which is reasonably symmetrical or normal about its average, then approximately $\frac{2}{3}$ of the values will be found in a range of ± 1 standard deviation from the average, 95% within ± 2 S.D.'s, and less than 1% will lie outside the range of ± 3 S.D.'s. An estimate of the standard deviation of a small sample is equal to the square root of the estimate of the variance. It is sometimes called the root-mean-square deviation.

$$s = \sqrt{\hat{V}} = \sqrt{\frac{\Sigma_1^N (X_i - \bar{X})^2}{N-1}}$$

The standard deviation applies to the individual measurement.

Standard Deviation of an Average: The standard deviation of an *average* of N measurements is equal to the standard deviation of the individual measurements divided by the square root of the number of measurements.

$$s_{Aver.} = \frac{s}{\sqrt{N}}$$

Standard Deviation of a Difference: The standard deviation of a *difference* between two values, where each value has the same standard deviation, is equal to the standard deviation of the values multiplied by $\sqrt{2}$.

$$s_{Diff.} = s \times \sqrt{2}$$

% Coefficient of Variation (v): This is a convenient form for expressing the *relative* variability of a group of measurements.

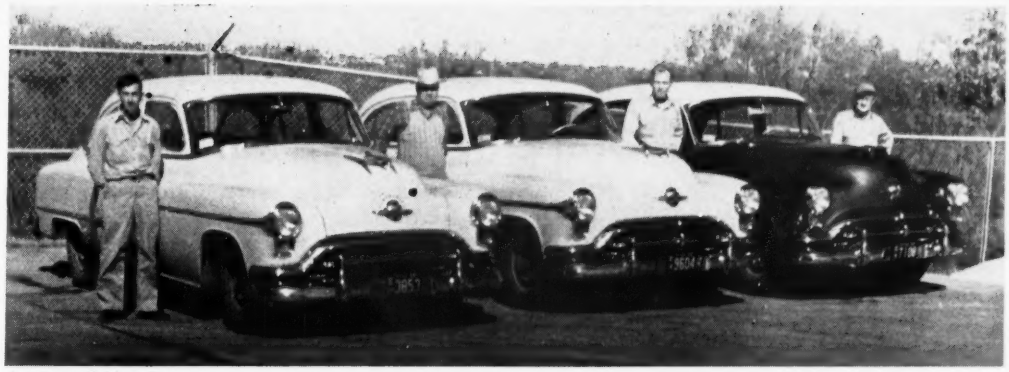
$$v = \frac{\text{estimate of standard deviation}}{\text{average}} \times 100 = \frac{100 \times s}{\bar{X}}$$

if the analysis of variance has been performed on the common logarithms of the data,

$v =$ estimate of the standard deviation of the common log $\times$ 2.3 $\times$ 100.

Coefficient of Variation of a Ratio: The coefficient of variation of a *ratio* of two values, where each of the values has the same coefficient of variation, is equal to the coefficient of variation multiplied by $\sqrt{2}$. This statistic is very valuable in the field of rubber testing where it is common practice to calculate *relative values* with reference to a standard control compound.

Analysis of Variance: This is a modern statistical technique by which the total variation in a set of data is reduced to possible sources of variability whose relative importance can be assessed. Analysis of variance is, in effect, an arithmetical process of splitting up the total variance of a group of measurements into its component



Armstrong Rubber Co.

Fig. 1. Three test cars from Armstrong Rubber Co.'s test fleet with some of the group of six drivers which operated these cars in order to obtain the data used in this paper

parts. It is based on the fact that the total variance V is equal to the sum of the variances resulting from independent causes, $V_1 + V_2 + V_3 + \text{— — —}$. One of these causes will be a residual variance. The standard deviation of the residual variance is then the square root of V_r,

$$s = \sqrt{V_r}$$

This standard deviation may be used as an estimate of the testing error when there are no significant interactions.

Interaction: This is a technical term in statistical terminology and is determined from a variance analysis. In an experiment involving the study of different factors, for example, "compounds" and "tests," the *interaction* is a measure of the influence of one factor on the effect of the other and is not significant if the relative results for the compounds are similar for all tests. A reversal of compound ratings in two tests would give rise to a so-called significant (compound x test) interaction. When there is no apparent explanation for such an interaction, such as might be the case if the tests were performed under very different service conditions, then the standard deviation of the interaction variance is taken as the estimate of the testing error and is an indication of the poor reproducibility of the tests.

Confidence Limits: If an estimate of the standard deviation of the testing error has been made, it is possible to calculate the probability that the true value falls within any assigned limits. Such limits may be called confidence limits or *probability limits*. They are similar to control limits familiar in quality control work.

Significance: A result which is very unlikely to have arisen by chance is said to be *statistically significant*. The judgment is based on probability, and the degree of confidence in the reality of the difference is described in terms such as "probably significant," "significant," or "highly significant," depending on the probability level associated with our judgment. In this paper, the level of significance used is the so-called 95% level, which means that five times out of 100, the result obtained would be due to pure chance.

"Student's" (W. S. Gosset) t Test: The t test is used to establish whether the difference between two average values could have arisen by chance differences in the individual values. t is the ratio between the difference between the two averages and the standard deviation of this difference. If the standard deviation of the individual values is s, then the standard deviation of the difference between averages is

$$\frac{s}{\sqrt{N}} \times \sqrt{2}$$

Thus

$$t = \frac{\overline{X} - \overline{Y}}{s} \sqrt{\frac{N}{2}}$$

The values of t which could arise by chance for various probabilities and numbers of measurements are given in standard statistical tables. The t values have been used in this paper to establish the minimum difference between two average values which must be exceeded to be significant at a given probability level.

F Test: This is a variance ratio test often referred to as Snedecor's F test (15), and the ratio F is in honor of R. A. Fisher (16). The t test is used to test for significant differences between two means; whereas the F test is used to detect differences between two variances. The variance ratio is defined as

$$F = \frac{\text{greater estimate of variance}}{\text{lesser estimate of variance}}$$

Statistical tables of F values are available showing the value of F which will be exceeded with a given degree of probability and for various sample sizes. The observed values of F must exceed the F values given in the tables for a given probability level to classify the greater estimate of variance as being significant.

Explanation of Symbols

$\hat{V}$ — estimate of variance, V.
v — % coefficient of variation.
N — number of individual measurements.
N-1 — degrees of freedom.
X_i — value of individual measurement, X.
$\overline{X}$ — average of individual measurements, X.
$\overline{Y}$ — average of individual measurements, Y.
s — estimate of the standard deviation, σ.

The design of tire road testing programs must take into consideration the expected precision of the measurements and the allowable range or limits of the results. If the allowable limits are narrow, it is obvious that a more extensive testing program will be required than if broader limits are acceptable. A more extensive program may consist of further road tests, added tires in the same test, continuing the test to obtain additional rotations, or designing a more comprehensive test including other factors as variables.

Although the work described in this paper was primarily done to establish and control the road wearing qualities of various grades of carbon blacks, it has also furnished other information of general interest in the field of road testing. This information includes (a) the use of variance analysis to aid in the interpretation of road test data, (b) whole tread *versus* two-way tread construction, (c) weight and depth measurements of rate of wear, (d) relative road wear ratings of natural and synthetic rubber compounds containing various grades of carbon black, and (e) effect of rate of wear on relative tread wear ratings.

Road Test Methods and Measurement Techniques

The whole and two-way tread tire road test programs analyzed statistically for a comparison of the errors involved in these two techniques of road testing were both run under the test conditions listed in Table 1. The tires were undersized for the vehicles used and other test conditions were chosen so as to promote relatively rapid wear.

Table 1

Tire size	6.70-15—4-ply
Speed	60 mph.
Inflation	24 psi.
Automobile	Oldsmobile 88
Tire load	1,100 lbs. (20% overload)
Location of test route	San Antonio, Tex. (100% pavement)

All tread compounds for a road testing program were specially mixed and extruded, and all tires were constructed and cured during the same period. Careful attention was given to obtaining uniform extruded tread weights and tread profiles.

Depth measurements were made with a Federal[3] depth gage. Ten measuring positions were marked off, spaced at about equal distances from one another circumferentially around the tread surface. At each of these 10 positions three depth measurements were made, at each of the shoulder grooves and at the center grooves. The center groove measurements were made at alternate sides of the center rib. An "average" tread depth was determined by obtaining separate averages for all 20 shoulder groove measurements and for the 10 center groove measurements and then averaging these two values. In effect, this practice gives the 10 center measurements equal weight to the 20 shoulder measurements in the final average. Thus this procedure represents a compromise between only using the center groove measurements and using all the groove measurements. In the case of two-way tires, five measuring positions were used on each half tread; no measuring positions were closer than five inches to the tread splices.

The sequence of wheel position changes was left front to left rear to right front to right rear to left front. Each tire was on each wheel position for about 1,050-1,100 miles, and the complete rotation mileage was 4,200-4,400 miles. The rotation mileages in all tests were accurately measured.

The weight method for measuring wear of the whole tires consisted in obtaining the original tire weight and thereafter weighing the complete tire assembly and obtaining the tire weight by difference.

Analysis of Road Test Data

Tire wear measurements are commonly made after the completion of each rotation of a road test, and the wear is expressed as a mileage rating, the units of which are miles per mil (0.001-inch) of tread depth loss, or as a rate of wear, the units of which are mils loss per 1,000 miles. If a road test program consists of more than one rotation, as is normally the case, then the total number of miles traveled by the tire is divided by the total depth loss in mils to obtain the mileage rating at the completion of each successive rotation.

In the utilization of this information, the mileage rating at the end of the final rotation is considered the most reliable. If the mileage rating of the test compound obtained in this manner is divided by the mileage rating of the control, one obtains the familiar "tread wear rating," a value which increases as the test compound is improved. In effect, this procedure ignores all the measurements made during the performance of the road test program except for the initial and final tread depth readings and provides no basis for estimating the reliability or precision of the final tread wear ratings.

An alternative procedure which avoids these objections is to determine rates of wear for each separate rotation from the measurements made at the beginning and the end of the rotation. In the case of the whole tire tests the rate of wear measurement was used in the variance analysis. In the case of a test design utilizing two-way tread tires having the same control half tread on each tire, it is desirable to calculate the relative tread wear ratings for each rotation and use these values for the variance analysis.

The average value of all the rotations has a testing error which depends on the number of rotations and which is determined by dividing the error of the individual rotations by the square root of the number of rotations. By applying statistical methods, it is possible to judge whether any significant differences exist between the tires or compounds, and also whether any significant effects on rate of wear or tread wear ratings have occurred during any of the rotations.

Statistical Analysis of Rate of Wear Measurements

The use of simple statistical techniques for the analysis of tire test data will be shown for the two-way tire road test program #5435. This test program was run to determine the road wear properties of five synthetic rubber passenger-tire tread compounds containing five different high abrasion furnace (HAF) blacks. Except for the difference in HAF blacks, the tire tread compounds were the same.

The tires were constructed to include in every tire a half tread of control compound A (HAF-AT) and a half tread of one of the other four HAF tread compounds. The four tires, consisting of the following compound combinations, A_1:B, A_2:C, A_3:D, and A_4:E, were tested for four complete 4,000-mile rotations to complete a road test of 16,000 miles. In this program four separate road tests were completed using four sets of four tires per set manufactured during the same period.

Rate of Wear for Control Half Tread Compound (Table 2)

Since control compound A was tested on every tire, it is possible with this test design to establish the testing error associated with the same tread compound tested on different tires during a complete rotation of a tire test. The use of the analysis of variance technique is illustrated in Table 2 for the rate of wear data in road test #3 of the control half tread compound.

The variance analysis was performed on the common logarithms of the rate of wear data. This was adopted as a general practice in this paper for treating absolute rate of wear measurements; whereas in the analysis of relative tread wear ratings the actual values rather than the logarithms were used.

An advantage to using "log data" is that the analysis is independent of the particular unit chosen to express the wear results, whether it is miles per mil depth loss or mils loss per 1,000 miles. The analysis of "log data" gives an estimate of variance which is easily converted into "coefficient of variation," the useful form for expressing conclusions. Average rate of wear measurement obtained from the averages of the

[3] Federal Products Corp., 1144 Eddy St., Providence, R. I.

Table 2. Road Test Program No. 5435—Test #3

HAF Blacks in Synthetic Rubber—Two-Way Treads
Rate of Wear in Mils/1000 Miles for Control Half Tread

	Control Compound A (HAF-AT)			
Rotations	Tire 1	Tire 2	Tire 3	Tire 4
1	19.1	19.0	19.8	20.2
2	14.1	14.1	14.8	14.7
3	12.0	13.1	12.4	12.6
4	21.0	22.1	20.4	20.4
Geometric Average	16.1	16.7	16.5	16.6
Average (m)	16.5			

Analysis of Variance

(Analysis performed on the common logarithms of the data)

Source of Variance	Degrees of Freedom	Sum of Squares	Variance	Variance Ratio (F)	Sig. at 5% Level
a) Tires (same compound)	3	0.000484	0.000161	.5(a/c)	N.S.
b) Rotations	3	0.135983	0.045328	142(b/c)	S.
c) Experimental error (Residual)	9	0.002860	0.000318		
All 16 values	15	0.139327			

Standard deviation of the residual error, $s = \sqrt{.000318} = 0.0178$

Coefficient of variation $(v) = 0.0178 \times 2.3 \times 100 = \pm 4.1\%$

Standard deviation of each tire average $(s_{average}) = \dfrac{v \times \text{average}}{100 \times \sqrt{n}} = \dfrac{4.1 \times 16.5}{100 \times 2} = 0.34$ mil/1,000 miles

n = number of values in average = 4

A *significant difference* between any two tires must be greater than

$S_{average} \times t \times \sqrt{2} = 0.34 \times 3.25 \times 1.41 = 1.6$ mils/1,000 mils

$t = 3.25$ (taken for 9 degrees of freedom and 99% confidence, since with four tires 6 separate comparisons of two tires can be made, giving the possibility of exceeding the limit by chance of 6 times out of 100, or a confidence level of 94%)

Table 3. Road Test Program 5435

Depth Loss for Control Half Tread Compound A in Mils/1,000 Miles

Tire Test No.	Rotations 1	2	3	4
1	11.3,12.6	8.6,8.6	10.3,11.4	14.0,14.6
	11.3,11.9	8.8,9.4	11.8,10.7	14.1,14.3
2	18.5,16.9	14.9,13.6	11.7,11.5	11.5,11.7
	14.5,16.4	12.4,14.3	10.4,10.5	10.2,10.8
3	19.1,19.0	14.1,14.1	12.0,13.1	21.0,22.1
	19.8,20.2	14.8,14.7	12.4,12.6	20.4,20.4
4	19.6,18.2	15.1,15.0	15.4,16.0	13.1,13.3
	17.7,18.1	14.9,13.6	14.4,15.5	13.0,13.2

Analysis of Variance

(Log Data Used for Analysis)

Source of Variance	Degrees of Freedom	Sum of Squares	Variance	Variance Ratio (F)	Sig. at 5% Level
a) Rotations (R)	3	0.147892	0.049297	(a/c)2.10	N.S.
b) Tire tests (T)	3	0.262717	0.087572	(b/c)3.74	N.S.
c) Interaction (R × T)	9	0.210577	0.023397		
d) Experiments	15	0.621186	0.041412	(d/e)77	S.
e) Residual error	48	0.025875	0.000539		
All measurements	63	0.647061			

Standard deviation $(s) = \sqrt{.000539} = .0232$

% Coefficient of variation $(v) = 0.0232 \times 2.3 \times 100 = \pm 5.3\%$

individual logarithms of the rate of wear is equivalent to the use of geometric averages and is recommended by Stiehler, *et al.* (1, 9-10).

The type of analysis shown in this table is described in most books on statistics (12-14). The analysis (Table 2) shows that no significant differences in rate of wear of compound A occurred among the four tires for a complete rotation; whereas a very large effect on rate of wear was obtained for the various rotations. The significance of the tire and rotation effects is judged by the ratio of the variance found for these effects and the residual error variance. The causes for the observed variations in rate of wear for the four rotations were not obvious.

This illustration serves to demonstrate a basic difficulty of road testing, and that is, the practical impossibility of duplicating absolute rate of wear measurements between rotations of a single tire test. The same difficulty applies even more strongly to a different set of tires run in a different tire test. In Table 2 the high degree of uniformity in the rate of wear of control compound A is reflected in the rather low coefficient of variation of 4.1%.

In order to establish whether a significant difference exists between any two tires it is also useful to apply "Student's" t test. This has been done in Table 2, and the tires must differ by more than 1.6 mils/1,000 miles to be significantly different at the 94% level. It is evident that the t test confirms the results found from the F ratios.

Rotations vs. Tire Tests (Table 3)

This same type of analysis of the control half tread rate of wear was made for all four tire tests comprising road test program 5435. In three of the four tests the differences in wear among the four control half treads were not significant. It was therefore decided to consider the rates of wear of the four control half treads as replicate measurements for each complete rotation within a tire test. This makes it possible by an analysis of variance to show the effects of the two factors, rotations and tire tests, and determine whether the so-called interaction between these two factors is significant. The standard deviation and coefficient of variation derived from these data include the tire-to-tire variations in contrast to the previous type of analysis shown in Table 2 where the tire variations were not included in the error, having been one of the factors considered in the analysis.

The standard deviation in this case (Table 3) will be greater than the average of the standard deviations obtained for the individual road tests because it includes the significant tire-to-tire variance obtained in one of the four road tests. This standard deviation gives an indication of the dispersion of wear rate data to be expected for a group of tires of identical construction made at the same time and tested on the same car for a single rotation. Table 3 lists the data used in this analysis and the results obtained.

The very large F values found for the "experiments" (sum of rotations, tire tests, and rotation x tire test interaction) proves that large variations in rate of wear exist from one rotation in a test to another rotation in another test. This F value was determined by the ratio of "experiments" variance to "residual" variance. Since the interaction variance is very significant when judged by the "residual" variance, it is necessary to use this interaction variance to assess the significance of the main effects, and when this is done, the F values obtained indicate that chance combinations of "experiment" differences could result in the observed variance of the test and rotation factors. The coefficient of variation of the individual rate of wear measurements is 5.3%.

The coefficient of variation of the rate of wear measurements is the cumulative effect of almost innumerable individual sources of error or variability in the manufacture of the test tires, in the measurement of the amount of wear, and during the actual road test itself since it is physically impossible to expose every tire to exactly the same service conditions. It has previously been mentioned that in road test program 5435 an analysis of four road tests showed that in three of these tests no significant differences were found in the rate of wear of the control half treads. If this is considered as an example of manufacturing variability or error, it seems evident that this source of individual error can be relatively small. The measurement error of depth loss is also felt to be relatively small since it represents an average of a large number of depth readings. Therefore, the major source of error is attributed to service variability or different treatments of the various tires during road testing.

Analysis of Tread Wear Ratings from Two-Way Tread Tests (Table 4)

Table 4. Road Test Program 5435—Test #3

Relative Tread Wear Ratings (Control ½ Tread Compound A = 100)
HAF Blacks in Synthetic Rubber—Two-Way Treads

	Test Compounds			
Rotations	B	C	D	E
1	96	92	106	104
2	97	97	107	106
3	99	99	104	99
4	99	100	102	99
Average rating	98	97	105	102

Analysis of Variance

Source of Variance	Degrees of Freedom	Sum of Squares	Variance	Variance Ratio (F)	Sig. at 5% Level
a) Compounds	3	160	53	(a/c) 5.5	S.
b) Rotations	3	11	3.7	(b/c) 0.4	N.S.
c) Residual error	9	87	9.7		
All 16 values	15	258			

Standard deviation of the residual error $(s) = \sqrt{9.7} = 3.1 =$ Coefficient of variation (v) since grand average rating is 100.

95% Confidence limits $= \frac{v \times t(9\ \text{D.F.})}{\sqrt{n}} = \frac{3.1 \times 2.26}{\sqrt{4}} = \pm 3.5\%$

Significant difference between any two averages must be greater than

$\frac{s}{\sqrt{n}} \times t \times \sqrt{2} = \frac{3.1}{\sqrt{4}} \times 3.25 \times 1.41 = 7\%$

$t = 3.25$ for 9 D.F. and 99% confidence (see Table 2) giving confidence level for all possible comparisons of 94%.

It is, of course, the purpose of two-way tread construction of tires to minimize the major source of testing error due to service variability of individual tires. To determine the relative rates of wear of two tread compounds under essentially equivalent conditions of service severity, both compounds are placed as half treads on the same tire carcass. In order to obtain uniform wear over the entire tread surface and to expose all tires to about the same severity of wear, such two-way tread test tires are run on all four wheel positions to complete a rotation. The relative tread wear rating is expressed as the average depth loss of the control half tread divided by the depth loss of the test compound half tread multiplied by 100. These ratings, determined for each separate tire test rotation, may be treated as the dependent variable in an analysis of variance instead of the rate of wear measurements as were previously used. Table 4 shows such an analysis for test #3 of program 5435.

An examination of the F value of Table 4 shows that the half treads composed of the different compounds are significantly different at a 95% confidence level. It is not possible to assign the observed variance to either normal tire-to-tire differences or to the different compounds since only one tire for each compound was tested.

The effect of rotations which was so very large in Table 2 for the absolute rates of wear is in this case insignificant for the relative tread wear ratings. Thus the differences in rate of wear found for the different service conditions of the various rotations for this test have little effect on the relative wear of the test compounds compared with the control compound. Since all the compounds were essentially the same except for different samples of HAF black, this result is to be expected.

If the test compounds were substantially different from the control compound in rate of wear, it is possible that the relative ratings obtained would be different for the various rotations depending on the rate of wear during each rotation. Such an effect was observed by Buist, Newton, and Thornley (3), and was also found for a road test program to be described later in this paper.

The standard deviation and coefficient of variation of the tread wear ratings in this road test are equivalent since the average of all values is equal to 100. This coefficient of variation for the relative ratings (Table 4) is 3.1%, compared with the value of 4.1% found for the absolute rate of wear for the same road test in Table 2. If it were assumed that the test compounds had the same coefficient of variation of the individual rate of wear measurements as the control compounds, then the ratio of these rate of wear measurements (the tread wear rating) would be expected to have a coefficient of variation equal to $\sqrt{2} \times 4.1 = 5.8\%$. This would be the case if the test and control compounds were tested on different tires in a whole tread tire test.

The fact that the observed coefficient of variation for the tread ratings was actually only 3.1% suggests that a large part of the testing error component due to differences in treatment was eliminated by the use of two-way tread test tires. This test seems to indicate that a single two-way tread tire rating is equivalent to $\left(\frac{5.8}{3.1}\right)^2 = 3.5$ whole tire ratings.

For a two-way tread test consisting of four test compounds compared with a single control in all four tires, and a whole tire test consisting of three test compounds in three tires and a single control tire, four ratings per rotation would be obtained in the two-way tread tire test and three ratings per rotation for the whole tire test. Therefore, using these test designs, the overall efficiency of the two-way tread tire test compared with the whole tire test is (4/3 x 3.5) or over fourfold. More information on this point will be given later.

An average tread wear rating is obtained by averaging the four rotation values for each test compound. The standard deviation of this average value is equal to the standard deviation of the individual measurements divided by the square root of the number of values used to calculate the average. In this case the standard deviation of the average equals $\frac{3.1}{\sqrt{4}}$ or 1.6%.

The fiducial or confidence limits have been chosen so that the true average value will fall within the limits 95 times out of 100 (i.e., 95% level). The confidence limits are obtained by multiplying the standard deviation of the average rating by "Student's" t value which is obtained from statistical tables, knowing the number of degrees of freedom in the standard deviation of the individual measurements. With nine degrees of freedom in this standard deviation t equals 2.26 at the 95% confidence level. The t value is greater for higher levels of confidence and with fewer individual values used to determine the standard deviation.

For road test #3 in Table 4 the 95% confidence limits are ±3.5%. A comparison of the four compounds with the control A shows that compound D is the only one that is significantly different from A at the 95% confidence level A significant difference at the 94% confidence level between any two of the four test compounds must be greater than 7%. On this basis, compound D is significantly better than compound C. The differences between the remaining possible comparisons are not large enough to be proved by the data from a single road test.

Compound Evaluation—Replicate Sets of Tires (Table 5)

The results of a single road test using one set of four tires composed of different compounds are applicable only to the particular tires used and the conditions prevailing during the test. This information is of limited value since we are concerned with the reproducibility of the compound performance in repeated testing with replicate sets of tires. It is evident that a truly general assessment of compound differences would include many more factors than these, such as different conditions of testing, different mixes of the same compound, different formulations, various tire sizes, constructions, and test designs, etc., etc. Since information on repeated testing with replicate sets of tires has not been reported in the literature, it was felt that this information would be valuable to the general problem of compound road wear evaluation.

The data for the four road tests of program 5435 are shown in Table 5. A variance analysis of the data was made, using as main factors "compounds," "road tests," and "rotations." It can be seen that a significant F ratio was obtained for the "compounds x tests" interaction. The "compounds x tests" interaction actually is a measure of the reproducibility of the compound ratings for different road tests. Therefore this value is used as the estimate of error for the compounds and is used to calculate the variance ratios for the "compounds" and "tests." These factors are not significant as shown in Table 5. The application of "Student's" t value to determine confidence limits gives a value of ±4.4% at the 95% level. Table 5 also shows that a significant difference between any two compounds must be greater than 9%. The t test, therefore, gives the same results as the F test, confirming no significant differences among the four compounds.

Table 5 includes an estimate of the coefficient of variation of the (compound x test) interaction. It is this value of 7.8% which is used to establish confidence limits for the various compounds, and not the much smaller coefficient of variation of the residual error. The limited usefulness of individual road tests is thus apparent for this road test program.

Two-Way Tread *vs.* Whole Tire Tread Testing

The coefficient of variation of the residual error was ±3.8% for road test program 5435. This value for the relative ratings applies to the individual measurements for a single rotation of a road test and can be compared with the coefficient of variation of the absolute rate of wear measurements of 5.3% found for the control half treads analyzed in Table 3 for the same road test program. Assuming the 5.3% error for the half treads is applicable to whole tire testing, another estimate of the efficiency of whole tire *versus* two-way tread tire testing can be made. The error of whole tire ratings would be $5.3 \times \sqrt{2}$ as discussed previously, and, there-

Table. 5. Relative Tread Wear Ratings of Program 5435
HAF Blacks in Synthetic Rubber — Two-Way Tread
Control Compound A = 100

	Compounds															
	B				C				D				E			
	Road Tests				Road Tests				Road Tests				Road Tests			
Rotations	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	93	109	96	110	98	92	92	99	105	100	106	97	98	104	104	105
2	96	107	97	101	92	91	97	103	115	104	107	110	102	111	106	99
3	92	111	99	98	95	97	99	95	109	105	104	94	104	106	9	103
4	99	113	99	101	95	102	100	94	101	102	102	102	112	104	99	99
Average		101.2				96.4				104.0				103.0		

Variance Analysis

Source of Variance	Degrees of Freedom	S.S.	Variance	Variance Ratio (F)	Sig. at 5%
a) Compounds	3	533	178	(a/d) 2.9	N.S.
b) Tests	3	148	49.3	(b/d) 0.8	N.S.
c) Rotations	3	35	11.7	(c/g) 0.8	N.S.
d) Compounds x tests	9	552	61.3	(d/g) 4.2	S.
e) Compounds x rotations	9	167	18.6	(e/g) 1.3	N.S.
f) Tests x rotations	9	122	13.6	(f/g) 0.9	N.S.
g) Residual	27	391	14.5		

Coefficient of variation of residual error $= \sqrt{14.5} = \pm 3.8\%$

Coefficient of variation of (compound x test) interaction $= \sqrt{61.3} = \pm 7.8\%$

95% Confidence limits for compound averages $= \pm 7.8/\sqrt{n} \times t$ (9 D.F.) $= \pm 7.8/\sqrt{16} \times 2.26 = \pm 4.4\%$

Significant difference between any two average ratings $> 7.8/\sqrt{n} \times t \times \sqrt{2} = 7.8/\sqrt{16} \times 3.25 \times 1.41 = 9.0\%$

t is chosen for 99% confidence and 9 D.F. to give 94% confidence for comparison of any two average ratings.

Armstrong Rubber Co.

Fig. 2. Instead of regular speedometers, tachographs (shown on the extreme right on the dash), recording speed, miles, and time, are used in all test fleet cars

fore, the efficiency of two-way tread testing is estimated as $\left[\frac{5.3 \times \sqrt{2}}{3.8}\right]^2$, or four times greater than whole tire testing. With the test designs used, this value must be multiplied by 4/3 to account for the number of compounds which can be tested by the two methods, so that the overall efficiency is five times in favor of the two-way tread tire method.

Table 6. Summarized Results from Two-Way Tread Tire Programs

	Program No. 5435	Program No. 558
Type rubber	GR-S	Natural rubber
Black Loading (parts)	50	42
Compounds	4 HAF vs. HAF control	4 ISAF, HAF, MPC vs. ISAF control
Number of individual road tests	4	3
Rotations test	4	3
Average rate of wear for control tread	14 mils / 1,000 miles	18 mils / 1,000 miles
Coefficient of variation of rate of wear of control half tread	5.3%	6.1%
Coefficient of variation for relative ratings of residual error	±3.8%	±4.1%
Coefficient of variation for relative ratings of (compounds x tests) interaction	±7.8%	±4.3%
No. of values in average	16	9
95% Confidence factor (t)	2.26 (9 D.F.)	2.09 (20 D.F.)
95% Confidence limits of relative ratings	±4.4%	±2.9%
Efficiency of two-way tread tire tests vs whole tires	$\left[\frac{5.3 \times \sqrt{2}}{3.8}\right]^2 \times \frac{4}{3} \simeq 5$	$\left[\frac{6.1 \times \sqrt{2}}{4.1}\right]^2 \times \frac{4}{3} \simeq 6$

In order to obtain further confirmation of the magnitude of the errors involved in two-way tread tire testing, another complete road testing program was analyzed by the techniques described above. Program 558 consisted in testing three sets of six two-way tread tires per set in the usual manner of placing each tire in every wheel position to complete a rotation of 4,300 miles. When six tires are tested, six wheel position changes are necessary for each rotation. Although the vehicle runs about 6,500 miles per rotation, each tire is on the vehicle for 4,300 miles per rotation. A single tire test consisted of three complete rotations.

This program included compounds containing a group of four commercial grades of ISAF (Intermediate Super Abrasion Furnace) black, an HAF (High Abrasion Furnace) black, and an MPC (Medium Processing Channel) black run against a standard control tread compound containing a standard ISAF grade. The results of program 558 are shown in Table 6 together with the results of program 5435. It will be noted that the magnitude of the testing error for the absolute rate of wear and relative tread wear rating measurements are about the same in the two programs.

The variance analysis for program 558 gave results in contrast to the previous two-way tire program 5435. The road tests were much more reproducible with respect to the compounds as evidenced by the fact that the (compounds x tests) interaction variance was small and not significant when compared with the residual variance. Therefore the residual variance was used in this case to estimate the testing error. The coefficient of variation of the residual variance was 4.1%. Following the previous procedure of comparing the error of the absolute rate of wear measurement with the error of the relative ratings, a testing efficiency of about 6 is found for the two-way tire tread method over the whole tire method.

ISAF, HAF, and MPC Blacks in Two-Way Tread Natural Rubber Tires

Figure 3 shows the average tread wear ratings and the 95% confidence limits of the averages for the complete program. ISAF-P is significantly better than the control compound (ISAF-L); ISAF-C1, HAF, and MPC are significantly poorer than the control; the difference, if any, between ISAF-T, ISAF-C2, and the control cannot be determined with the

(Continued on page 639)

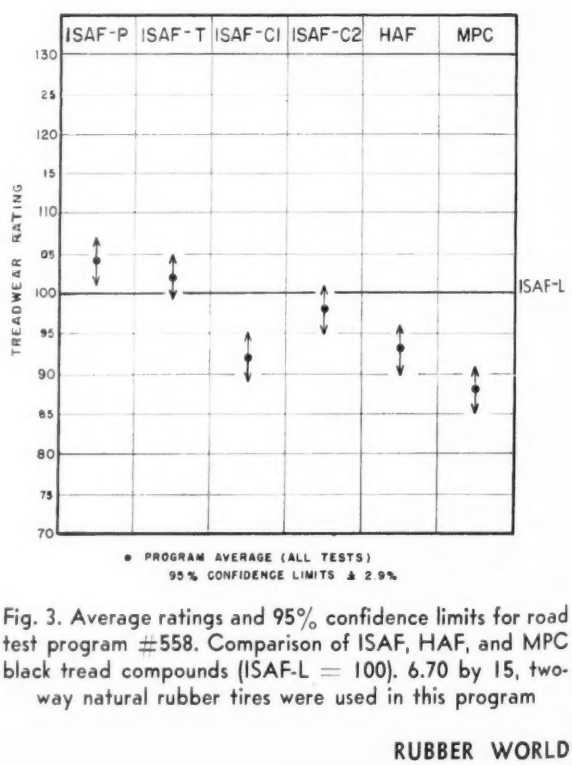


Fig. 3. Average ratings and 95% confidence limits for road test program #558. Comparison of ISAF, HAF, and MPC black tread compounds (ISAF-L = 100). 6.70 by 15, two-way natural rubber tires were used in this program

Comparison of Strain Gage and Pendulum Types of Dynamometers for Tensile Testing[1]

By Robert R. James and Ross E. Morris

Mare Island Naval Shipyard, Vallejo, Calif.

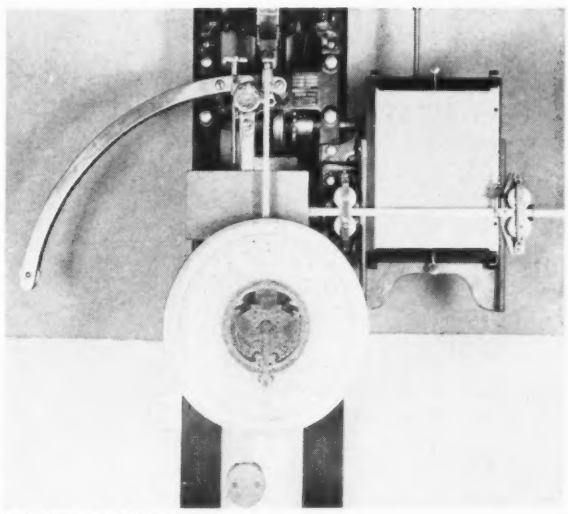
A strain type and a pendulum type of dynamometer for use with the tensile testing machine for rubber manufactured by Scott Testers, Inc., were compared, using eight vulcanizates of widely different stress-strain characteristics.

The average values of the tensile strength and stress at 100% elongation obtained with the two dynamometers were in close agreement, except in the case of tensile stress at 100% elongation when testing a soft natural rubber stock, where the strain gage-type dynamometer probably gave more accurate values and definitely yielded greater precision of testing.

Physical tests in which specimens are subjected to tension stresses are widely used for determining the quality of rubber products. Almost all specifications for rubber products contain requirements for tensile strength, ultimate elongation, and sometimes tensile stress at some given elongation. Procedures for determining these properties have been quite thoroughly studied by many investigators, using various types of testing machines and test specimens. Three machines generally used at present are the Scott,[2] the Olsen,[3] and the Schopper,[4] all of which employ a dynamometer of the pendulum type. Test procedures which may be used with these machines have been recommended by the ASTM,[5] and they have been generally accepted throughout the rubber industry.

Dynamometers of the pendulum type are subject to errors of load indication due to inertia and momentum effects, friction in the bearings supporting the pendulum, friction caused by dragging of pawls needed to hold the pendulum at the breaking load, and friction in the associated autographic system which is actuated by the movement of the pendulum. The inertia and momentum effects alone contribute so much error that values within the lower 15% and upper 15% of the load range of a pendulum-type dynamometer are not considered valid.[5]

Recently a new type of dynamometer and recording system has been developed for use in tension testing. The new unit makes use of a mechanico-electrical transducer whereby mechanical force is converted into an electrical signal. This electrical signal is fed into a recording potentiometer, thus giving an autographic record of the mechanical load. This type of load measuring and recording system is essentially inertialess and frictionless over its entire load range. This unit is known as an Accr-O-Meter, and it is sold by Scott Testers, Inc., as a direct replacement for the pendulum dynamometer and autographic unit now used on Scott tension testing machines.



U. S. Navy Official Photograph

Fig. 1. Close-up of Scott Model ORR measuring head mounted on Model L-6 tensile tester

Since the Accr-O-Meter appeared to have many advantages over presently used systems, it seemed desirable to make a thorough comparison of the two types of dynamometers. Accordingly, an investigation was initiated to determine whether the new unit would give more accurate and reproducible results than the presently used pendulum system and to determine the relative ease of use of the two systems.

Description of Equipment

Two Scott tensile testers were used in this investigation. One tester was equipped with a Model ORR measuring

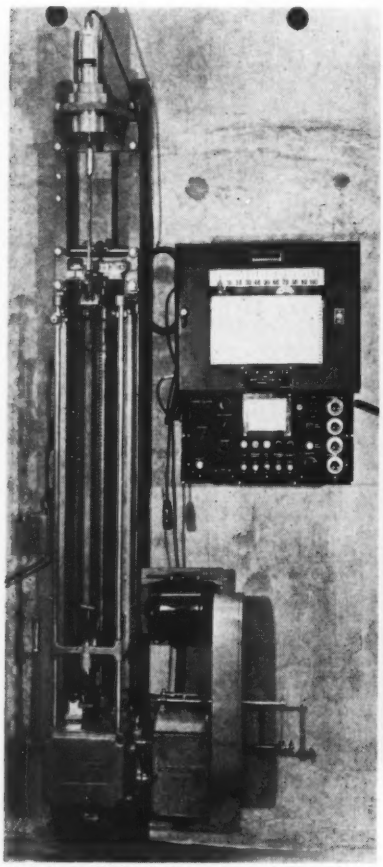
[1] The opinions or assertations in this article are those of the authors and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.
[2] Scott Testers, Inc., Providence, R. I.
[3] Tinius Olsen Testing Machine Co., Rydal, Pa.
[4] Testing Machines, Inc., New York, N. Y.
[5] ASTM Method of Test D412-49T, American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

head, which is the latest improvement in a pendulum dynamometer. A close-up view of the dynamometer and the associated autographic mechanism is shown in Figure 1.

A feature of this unit is a rotary solenoid which raises the pawls from contact with the serrated quadrant as soon as a load of one to two pounds is placed on the dynamometer. When the specimen under test ruptures and thus releases the load on the dynamometer, the solenoid is de-energized, and the pawls drop against the quadrant. Another feature is the improved pen carriage on the autographic unit.

The other tester was equipped with an Accr-O-Meter. Figure 2 is an overall view of the tester. The dynamometer can be seen installed at the top of the machine, and the autographic unit can be seen at the right of the tester. This tester will be referred to hereinafter as the Accr-O-Meter.

Figure 3 is a close-up view of the dynamometer with the protective shield removed, thus exposing the transducer.



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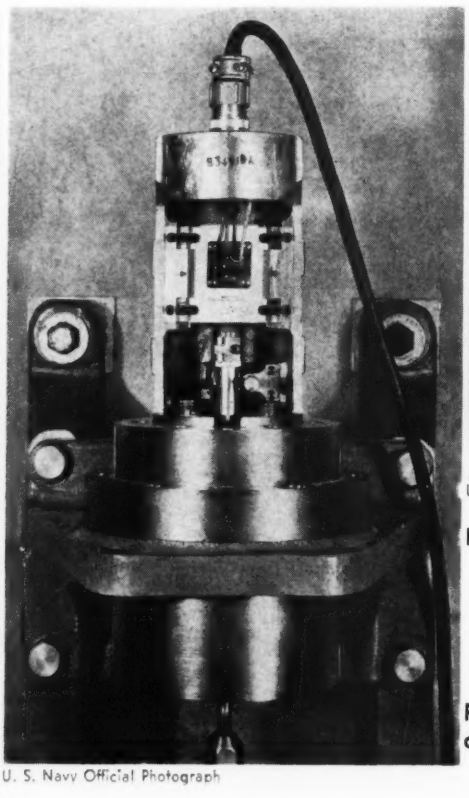

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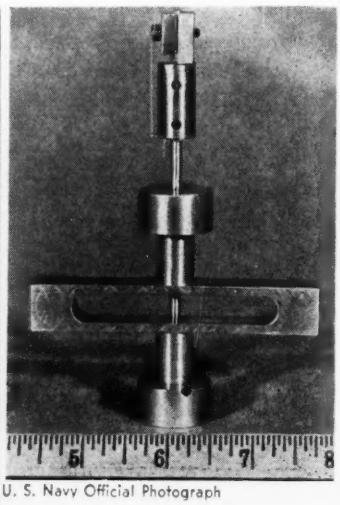
(Left)

Fig. 3. Close-up of Accr-O-Meter dynamometer with protective shield removed



U. S. Navy Official Photograph

Fig. 4. Force divider used in Accr-O-Meter dynamometer

Fig. 2. (Left) **Scott Model L-6 tensile tester with Accr-O-Meter dynamometer and autographic unit**

The transducer is a Model G1-1.5-315 strain gage which employs unbonded elements arranged in a bridge circuit. The capacity of the transducer is only 1.5 ounces.

In order to prevent the transducer from being subjected to excessive loads, the actual load imposed on the transducer is reduced by means of a force divider which is attached to the transducer. The force divider, shown in Figure 4, is actually a very stiff spring. The upper part of the force divider can be seen attached to the transducer in Figure 3. By this arrangement a maximum load of 200 pounds can be imposed without exceeding the strain limit of the transducer.

A closeup view of the autographic unit is shown in Figure 5. The unit is a special Brown Electronik[6] strip-chart recording potentiometer modified to provide the necessary electric activation to the transducer bridge circuit. Circuits are also provided to enable range changing, zero adjustment, and calibration of the load range. It is possible through suitable choice of dial settings to adjust the Accr-O-Meter for any full-scale load range from 0 to 10 pounds to 0 to 200 pounds. This feature offers considerable advantage over the pendulum dynamometer, which ordinarily can be used only for a maximum of two load ranges.

One inconvenience of the Accr-O-Meter is that it is not compensating, that is, it can only measure the load imposed; it cannot be adjusted to compensate for width and thickness of a test specimen and thus yield load data in terms of pounds per square inch. In this investigation this difficulty was partially overcome through the use of special scales which, when laid on the autographic record, converted the direct load values to pounds per square inch. It was necessary, of course, to make a record of the thickness of each specimen at the time the specimen was tested.

Stocks Tested

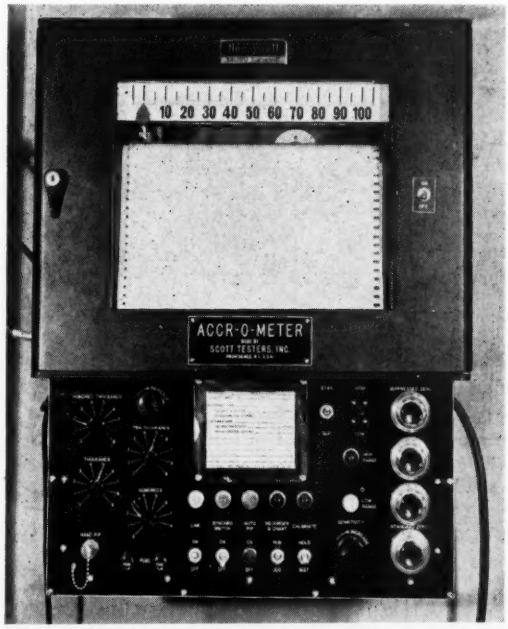
Eight stocks were selected for testing on the basis of anticipated differences in stress-strain relations between them. It was desired that as wide a range as possible of stress-strain relations be utilized when comparing the pendulum dynamometer with the Accr-O-Meter. Tests were performed on natural rubber (A) and GR-S (E) tread stocks, natural rubber (B and C) and GR-S (F) gasket stocks,

[6] Brown Division, Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

a GR-S (D) friction stock, a GR-I (G) tube stock, and a nitrile rubber (H) pump valve stock. The recipes for the stocks are shown in Table 1.

The stress-strain curves for the stocks are shown in Figure 6. It will be noted that the stocks differed considerably in their stress-strain properties.

The wide range of stress-strain characteristics in the various stocks being tested was wanted because it was thought that the effect of inertia on the results obtained with the pendulum dynamometer would depend on the character of the stock being tested. This follows from the fact that the stiffer the stock being tested, the faster the pendulum is called upon to move, and fast movement of the pendulum is resisted by its own inertia. It was felt that the Accr-O-Meter, being essentially inertialess, would record the correct stress whatever the stiffness of the specimen.



U. S. Navy Official Photograph

Fig. 5. Close-up of Accr-O-Meter autographic unit

Specimen Preparation

Twelve slabs six- by six- by 0.08-inch were prepared from each of the stocks. The slabs were cured at the temperatures and times shown in Table 1. Six dumbell-shaped test specimens were died from each of the slabs with a die conforming to the dimensions of ASTM Die C.[5] The constricted portion of the test specimens was $1\frac{5}{16}$ inches long by ¼-inch wide.

Since tests were to be performed on two machines, the specimens were divided into two groups. In order to insure fair sampling, alternate specimens were placed in two piles as they were died from the slabs. All specimens were allowed to condition in the dark for a minimum of seven days at room temperature between curing and testing.

Test Procedure

Since the sole purpose of this investigation was to evaluate the performance of the two dynamometers, every effort was made to eliminate the effects of personal bias, to maintain identical testing conditions, and to minimize differences in specimen preparation. The test specimens were prepared by the same person who performed all of the tension tests. Tests on a given stock were carried out on both dynamometers on the same day. All tests were performed within the temperature range of 80 to 84° F. Both dynamometers were standardized with dead weights before each series of tests.

A total of 36 specimens from each stock was tested with each dynamometer. The values for tensile stress at 100% elongation, tensile strength, and ultimate elongation of each stock were averaged, and the standard deviation[7] and coefficient of variation calculated for each property. Standard deviation was calculated according to the following equation:

$$\text{Standard deviation} = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

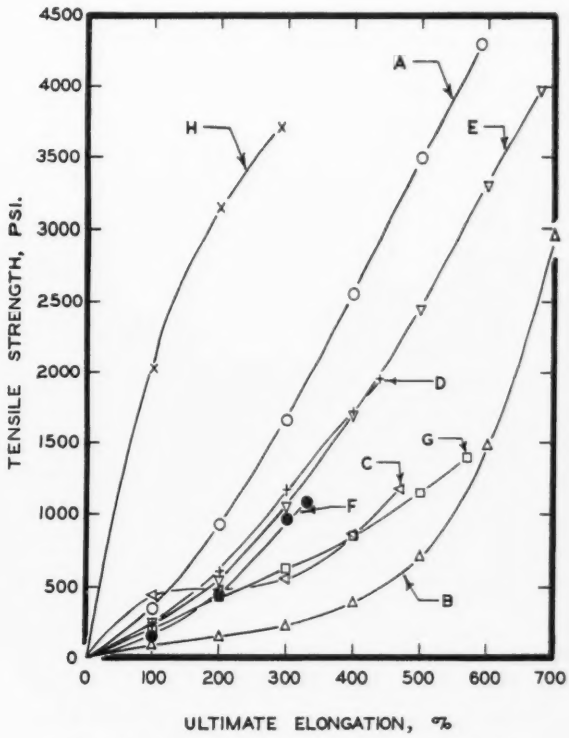


Fig. 6. Stress-strain curves of stocks tested

where x_i = individual values in a set
$\bar{x}$ = average of 36 values in a set
n = number of values in a set = 36

Coefficient of variation is the standard deviation expressed as a % of the average value.

Results and Discussion

The results of the tests are summarized in Table 2. The dispersion of individual values obtained on each set of test specimens using either dynamometer appeared in most cases to be normal. The coefficients of variation for tensile strength and tensile stress for all stocks except B, D, F, and G were 10% or lower, which is considered to indicate reasonable dispersion.

The reason for the somewhat high coefficient of variation for tensile strength of stock F can be attributed to the fact that the GR-S soft gasket stock was vulcanized at a high

[7] The root mean square deviation of observed values from their average.

Table 1. Recipes for Stocks Tested

Stock Identification	A	B	C	D	E	F	G	H
Smoked sheet	100	100	100					
GR-I							100	
Geon Polyblend 500x503 (a)								100
Hycar 1001 (a)								30
GR-S 1009						40		
GR-S 1000						60		
GR-S 1500				100	100			
Micronex Std. (b)	50							40
Pelletex (c)		2		25			30	
Philblack A (d)							30	
P-33 (e)			5					
Wyex (f)				10	40			
Statex B (b)						50		
Purecal M (g)			200					
Zinc oxide	3	5	5	3	5	5	5	
Litharge								10
Stearic acid	3	1	5	1	1.5			2
Pine tar	3							
Califlux 510 (h)		3						
Reogen (e)				3				
Rosin oil				3				
Dibutyl sebacate							25	
Flexol TOF (i)						20		
Heliozone (j)		3	3			1		
Santoflex AW (k)						2		
Neozone A (j)	1							
Neozone D (j)		1	2					
AgeRite Stalite (e)				1				
AgeRite Resin D (e)		1						
Captax (e)	1.35	0.5					0.5	
Methyl Tuads (e)		0.5	0.1			1.5	1	
Altax (e)		0.5	1	1.2	3			1
Tellurac (e)							1	
Ledate (e)				0.25				
Sulfur	2.75	0.75	3.25	2.5	2	1	2	2
Sheet cure—min.	70	40	20	50	50	15	20	30
@ °F.	260	260	260	230	290	310	310	330

(a) B. F. Goodrich Chemical Co., Cleveland, O.
(b) Binney & Smith Co., New York, N. Y.
(c) Godfrey L. Cabot, Inc., Boston, Mass.
(d) Phillips Petroleum Co., Bartlesville, Okla.
(e) R. T. Vanderbilt Co., New York, N. Y.
(f) J. M. Huber Corp., New York, N. Y.
(g) Wyandotte Chemicals Corp., Wyandotte, Mich.
(h) Golden Bear Oil Co., Oildale, Calif.
(i) Carbide & Carbon Chemicals Co., New York, N. Y.
(j) Monsanto Chemical Co., rubber chemical sales, Akron, O.
(k) E. I. du Pont de Nemours & Co., Inc., rubber chemicals division, Wilmington, Del.

Table 2. Comparison of Tensile Properties Measured with Two Tensile Testers

Stock identification	A		B		C		D	
Type of stock	Tread		Soft Gasket		Low-Grade Gasket		Friction	
Type of rubber	Natural Rubber		Natural Rubber		Natural Rubber		GR-S	
Testing machine	Pendulum	Accr-O-Meter	Pendulum	Accr-O-Meter	Pendulum	Accr-O-Meter	Pendulum	Accr-O-Meter
Average tensile strength, psi.	4290	4200	2960	2910	1180	1190	1950	1900
Standard deviation	98	84	187	197	121	103	204	207
Coefficient of variation	2	2	6	7	10	9	10	11
Average ultimate elongation, %	590	600	700	700	470	470	440	430
Standard deviation	15	14	17	17	23	19	36	30
Coefficient of variation	3	2	2	2	5	4	8	7
Average stress at 100% elongation, psi.	360	340	90	60	450	460	250	230
Standard deviation	16	21	30	10	4	10	10	16
Coefficient of variation	4	6	33	17	1	2	4	7

Stock identification	E		F		G		H	
Type of stock	Tread		Soft-Gasket		Inner Tube		Pump Valve	
Type of rubber	GR-S		GR-S		GR-I		Geon Polyblend	
Testing machine	Pendulum	Accr-O-Meter	Pendulum	Accr-O-Meter	Pendulum	Accr-O-Meter	Pendulum	Accr-O-Meter
Average tensile strength, psi.	3980	3840	1080	1090	1390	1350	3720	3620
Standard deviation	352	342	133	155	106	106	140	102
Coefficient of variation	9	9	12	14	8	8	4	3
Average ultimate elongation, %	680	670	330	320	570	560	290	290
Standard deviation	41	41	26	29	30	28	21	23
Coefficient of variation	6	6	8	9	5	5	7	8
Average stress at 100% elongation, psi.	250	240	150	150	200	190	2030	2000
Standard deviation	17	16	11	11	13	21	140	58
Coefficient of variation	7	6	7	7	6	11	9	3

enough temperature to cause a fast rate of set-up. Undoubtedly, more than the usual number of random strains due to mold flow were fixed in the slabs by vulcanization. The presence of these strains in the constricted portion of the dumbbell test specimens undoubtedly caused the precision of the test results to suffer.

The coefficient of variation for tensile stress of the pure-gum natural rubber stock, B, was high for at least two reasons. In the case of the tests with the pendulum dynamometer, the high coefficient reflects, in part, variable friction and momentum effects in the dynamometer head and errors in reading the autographic chart correctly. In the case of the tests with the Accr-O-Meter, the high coefficient of variation was due almost entirely to errors in reading the autographic chart correctly. The smallest scale division on the charts of both dynamometers was 50 psi.; therefore estimation of interpolated values was accurate to only about ±10 psi. Since all individual values were rounded off to the nearest 10 psi., and since the individual values were quite low anyway, errors in the reading of the individual values could cause significant variations about the mean.

The average values for tensile strength and tensile stress show that the pendulum dynamometer in most cases yielded slightly higher values than the Accr-O-Meter. This result was probably due to the momentum of the pendulum causing it to ride by the true stress. Only in the case of the tensile stress for stock B specimens was the difference between the averages of practical significance. This behavior was contrary to what was expected because it was believed that the inertia of the pendulum would cause low readings, particularly at the low values for tensile stress. Apparently the momentum effect was more significant than the inertia effect.

The difference in values observed for tensile stress at 100% elongation of stock B is considered to be quite significant. It was mentioned earlier that friction and momentum effects were responsible for some of the wide variations noted in individual values obtained for tensile stress on this stock in the tests with the pendulum dynamometer. The friction component which was important in this case was caused by the dragging of the pawls on the serrated quadrant. When the specimen under test exerted sufficient force to cause the pawl-raising mechanism to operate, the additional increment of force made available through the elimination of pawl drag caused the pendulum to acquire a momentum which, in some cases, made it coast past the true load value for 100% tensile stress, thus giving a high reading. It should be emphasized that this condition was only significant for very low load values. Since the friction and momentum effects were not present in the Accr-O-Meter, the values obtaind on this machine are considered to be closer to the true 100% tensile stress.

The values for tensile stress at 100% elongation of all stocks except H were less than 10% of full scale for the dynamometer ranges used on the respective machines. It is believed that the values obtained on the Accr-O-Meter are accurate. Since there was no significant difference between the values for tensile stress on the two dynamometers, except in the case of stock B, it appears that values of less than 15% of full scale can be considered valid, at least in the case of the dynamometers used in this investigation.

There was no difference between ultimate elongation values obtained on the two machines. This result was expected because the measurement of ultimate elongation is not related to machine performance, but is dependent rather upon the skill of the operator in measuring elongation.

Conclusions

The following conclusions are based on the work done.

(a) No significant differences in tensile strength and ultimate elongation values were obtained in the tests with the two dynamometers.

(b) Tensile stress values at low stresses are considered to be more accurate on the Accr-O-Meter because of the absence of friction, inertia, and momentum effects.

(c) The Accr-O-Meter is a more convenient instrument to use than the pendulum dynamometer in some respects, and less convenient in others.

Acknowledgment

The authors wish to express their appreciation to Barry Jan and Ernest Caldwell of this laboratory for preparing the stocks and performing the measurements reported herein, and to Theodore A. Werkenthin of the Bureau of Ships for his interest in this investigation.

Road Wear Rating

(Continued from page 634)

available data. At the 94% confidence level a significant difference between any two compounds would have to exceed 6.3%.[4] On this basis, the MPC compound is poorer than the ISAF-P, ISAF-T, and the ISAF-C2 compounds. The ISAF-C1 and the HAF compounds are poorer than ISAF-P and ISAF-T. The data do not allow any further significant comparisons at the confidence level used.

It must be emphasized that these results apply only to the particular compounds and mixes used in the construction of the test tires. Although the results obtained are probably mainly due to the differences in the types of blacks used, it is also possible that unavoidable mixing and curing variations have introduced some bias in the results.

Bibliography

(1) *Ind. Eng. Chem.*, 43, 2901 (1951).
(2) C. C. Biard, J. F. Svetlik, India RUBBER WORLD, 127, 363 (1952).
(3) *Trans. Inst. Rubber Ind.*, 26, 288 (1950).
(4) H. C. J. DeDecker, R. Houwink, G. J. Van Amerongen, "Tread Wear and Fuel Consumption of Tires." RUBBER WORLD, 130, 678 (1954).[5]
(5) I. J. Sjothun, P. S. Greer, *Rubber Age (N. Y.)*, 74, 77 (1953).
(6) I. J. Sjothun, P. S. Greer, S. N. Rhodes, *Ibid.*, 231.
(7) D. G. Stechert, T. D. Bolt, *Anal. Chem.*, 23, 1641 (1951); *Rubber Chem. Tech.*, 25, 321 (1952).
(8) R. D. Stiehler, G. G. Richey, J. Mandel, *Rubber Age (N. Y.)*, 73, 201 (1953).
(9) R. D. Stiehler, M. N. Steel, J. Mandel, *Trans. Inst. Rubber Ind.*, 27, 298 (1951); *Rubber Chem. Tech.*, 25, 656 (1952).
(10) R. D. Stiehler, M. N. Steel, J. Mandel, "Some Factors Influencing the Road Wear of Tires." India RUBBER WORLD, 125, 451 (1951).[5]
(11) J. I. S. Williams, R. G. Clifton, "Pneumatic Tire Testing." *Ibid.*, 130, 675 (1954).[5]
(12) W. J. Youden, "Statistical Methods for Chemists." John Wiley & Sons, Inc., New York (1951).
(13) Owen L. Davies, "Statistical Methods in Research and Production." Oliver & Boyd, London (1947).
(14) M. J. Moroney, "Facts from Figures." Penguin Books, Inc., Baltimore (1954).
(15) George W. Snedecor, "Statistical Methods," Fourth Edition. Iowa State College Press, Ames (1948).
(16) Ronald A. Fisher, "Statistical Methods for Research Workers," Eleventh Edition. Oliver & Boyd, Edinburgh (1950).

(To be continued)

[4] Significant difference at 94% confidence $> s/\sqrt{n} \times t \times \sqrt{2} = 4.1/\sqrt{9} \times 3.25 \times \sqrt{2} = 6.3\%$ (t is chosen for 99.6% confidence and 20 D. F. since with 6 compounds 15 comparisons can be made to give confidence for any single comparison of 94%.)

[5] Abstract.

The Behavior of Highly

It has been discovered from stress-strain curves of natural and synthetic rubber vulcanizates containing up to 60% v/v of mineral filler of greater than 1 mμ particle size, that there is a plateau at which elongation increases several hundred % at constant stress.

The significance of the observations obtained from varying filler content, particle size, and degree of cure, and the stress at which the plateau occurs and its length, with special reference to the experimental verification of equations relating modulus to filler content, are pointed out.

The volume changes accompanying the elongation of these vulcanizates for varying filler contents, particle sizes, and degrees of cure have been shown to correlate with the stress-strain curves.

It is suggested that these results have a bearing on the nature of rubber-filler bonds and the reinforcing action of fillers.

By K. C. Bryant and D. C. Bisset

Monsanto Chemicals, Ltd., Fulmer, Slough, Bucks, England

It is well known that the physical properties (such as tensile strength, tear resistance, and abrasion resistance) of a filled vulcanizate pass through an optimum as the percentage of mineral or carbon filler increases. The behavior of very highly filled vulcanizates containing 40 to 60% filler by volume has been comparatively little studied, since physical properties are then well past the optimum, and deteriorating as the filler content increases. The present investigation was undertaken to determine the point at which these highly filled materials lose their extensibility, becoming brittle, and the factors which govern this condition.

Very little reference is made to carbon black stocks since mixes at relatively low volume percentages are too stiff for manipulation on a roll-mill, or for molding.

Experimental Details

The following recipes and curing times were generally used, unless specific effects were being sought:

Filler	x
Pale crepe	100
Zinc oxide	5
Stearic acid	1
Sulfur	3
Thiotax*	1

Cure: 30' at 141.5° C.

Filler	x
GR-S (Polysar S)†	100
Zinc oxide	5
Stearic acid	1
Thiotax*	1
DPG	0.5
Sulfur	3

Cure: 40' at 145° C.

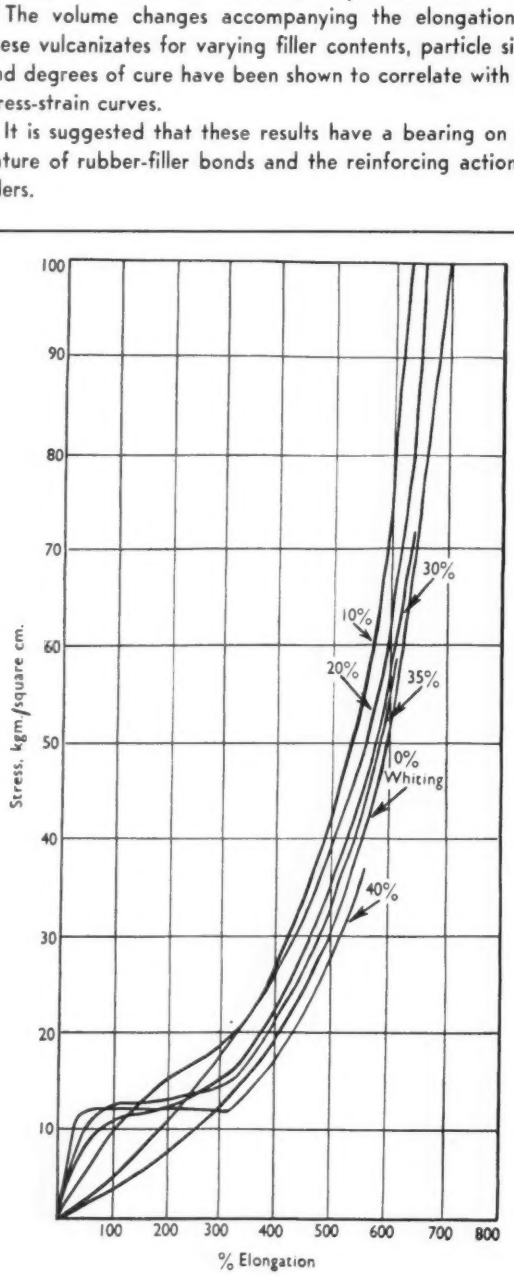


Fig. 1. Stress-strain curves for pale crepe compound with whiting over the range of 0 to 40% v/v

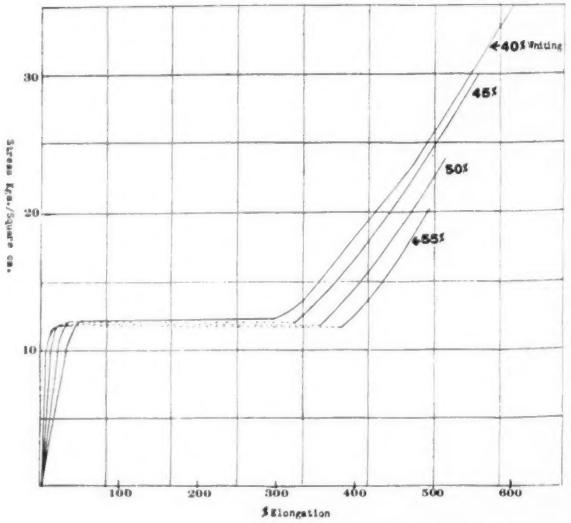


Fig. 2. Stress-strain curves for pale crepe compound with whiting over the range of 40 to 55% v/v. From Figs. 1 and 2 it may be seen that above 35% the curve consists of an initial steep rise, the plateau at constant stress, and final elongation to breaking point

Filled Rubber Vulcanizates[1]

Filler	x	Filler	x
Butadiene/acrylonitrile rubber (Hycar OR-15)‡	100	Butyl rubber (Polysar butyl)†	100
Zinc oxide	5	Zinc oxide	5.0
Stearic acid	1.0	Stearic acid	1.0
DPG	0.1	Sulfur	1.6
Santocure*	1.0	Thiurad*	1.0
Sulfur	2.5	Thiotax*	1.0
Cure: 40' at 145° C.		Cure: 45' at 150°C.	

* Monsanto Chemical Co., Rubber Chemicals Sales, Akron, O.
† Polymer Corp., Ltd., Sarnia, Ont., Canada.
‡ B. F. Goodrich Chemical Co., Cleveland, O.

Since the density of the fillers varied widely, results are always compared on a volume/volume basis.

Stress-Strain Curves

The values for the stress-strain curves were normally measured by a Goodbrand R_{77}[§] tensile testing machine, using rings cut from four-millimeter molded sheet with an elongation rate of five inches/minute, corresponding to about 160%/minute.

For measurements at low elongations a B.R.P.R.A. modulus tester[2] was used, with molded dumbbell specimens of effective length 15 centimeters. Extensions were carried out stepwise at 10% intervals with the same timing as for the volume change measurements.

Volume Changes on Elongation

The apparatus used was essentially the same as that of Holt and McPherson;[3] the tube was made of glass with a sealed-on side tube, graduated Veridia glass capillaries, and brass end-plugs. The specimen was that used with the

1 Presented before the Third International Rubber Technology Conference, London, England, June 23, 1954.
§ Goodbrand & Co., Ltd., Stalybridge, Cheshire, England.
2 W. P. Fletcher, G. Gee, S. H. Morrell, "Trans. Inst. Rubber Ind.," 28, 92 (1952).
3 W. L. Holt, A. T. McPherson, "J. Research Natl. Bur. Standards," 17, 657 (1936).

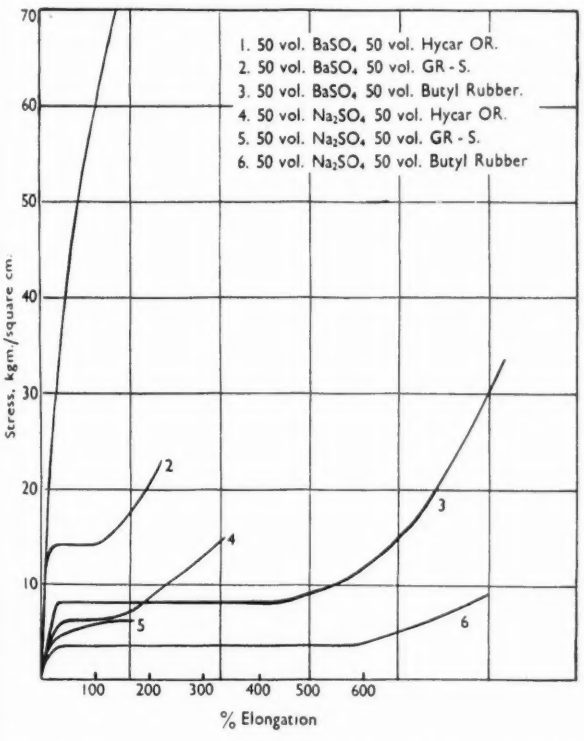

1. 50 vol. BaSO4 50 vol. Hycar OR.
2. 50 vol. BaSO4 50 vol. GR-S.
3. 50 vol. BaSO4 50 vol. Butyl Rubber.
4. 50 vol. Na2SO4 50 vol. Hycar OR.
5. 50 vol. Na2SO4 50 vol. GR-S.
6. 50 vol. Na2SO4 50 vol. Butyl Rubber
Stress, kgm./square cm.
% Elongation

Fig. 3. Stress-strain curves for nitrile, GR-S, and Butyl rubbers with barium sulfate and sodium sulfate, which also show plateau effect

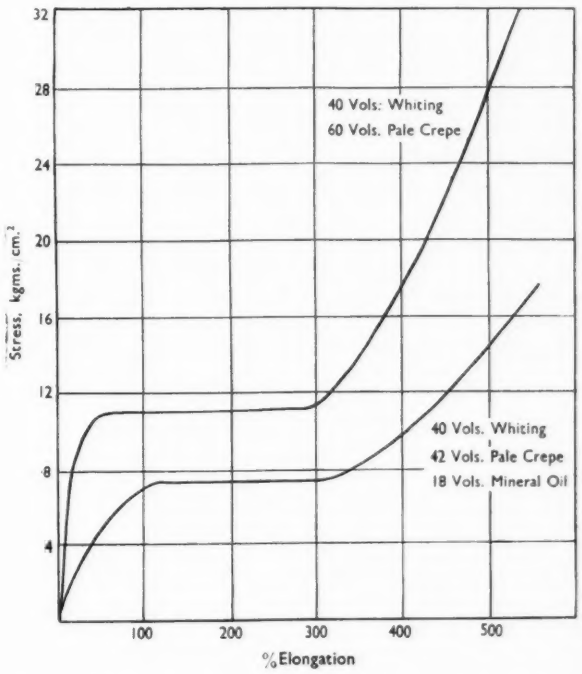


Fig. 5. Effect of softeners on stress-strain curve. Plateau is reduced. Whiting in pale crepe compound

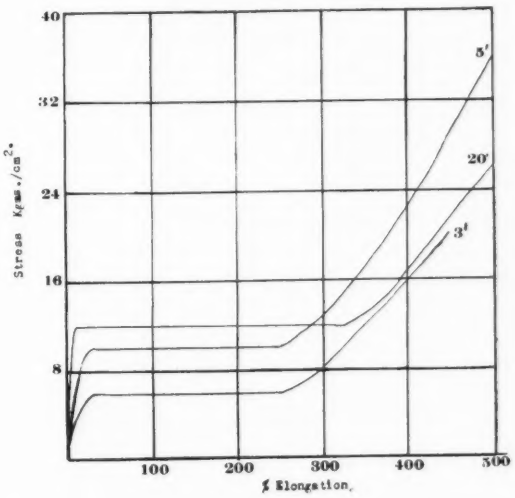


Fig. 4. Effect of time of cure on stress-strain curve. Whiting in pale crepe compound

B.R.P.R.A. modulus tester; the grips were modified accordingly, thus giving a relatively higher specimen volume so that more easily readable volume changes over the limited elongation range of 0-100% could be obtained. The apparatus was immersed into a large thermostatted tank; the practicable size of this tank limited the elongation which could be used with the available specimen.

Experimental Results

Stress-Strain Curves

Figures 1 and 2 show the stress-strain curves obtained with whiting (surface area ca. 8,000 $cm.^{-1}$) and pale crepe over the ranges 0 to 40% and 40 to 55% v/v. Above about 35% the curve can be seen to consist of three portions:

(a) The initial steep rise up to a few % elongation.
(b) The plateau at constant stress.
(c) The final elongation to the breaking point, the "tail."

On the plateau the sample appears to elongate at constant tension, but this condition is only because the tensile tester refers the stress to the initial cross-section, and the plateau would be replaced by a gently rising line if the stress were referred to the actual cross-section. Along the plateau the sample frequently has a knotted appearance with hard lumps separated by softer material until at the end of the plateau the knots have disappeared. Considerable permanent set is obtained, and a second elongation gives a curve resembling in shape that of a gum stock.

This plateau effect has been found for a number of mineral fillers with several rubbers, e.g., whiting, barium sulfate, sodium sulfate, sodium carbonate, and clay with pale crepe, GR-S, Hycar OR-15, and Butyl rubber (see Figure 3). It is therefore to be regarded as a general effect and not confined to any given elastomer/filler system, though it may not always be observed.

The chief properties of these curves can be summarized as:

(a) The slope of the initial portion increases with filler content.
(b) The height of the plateau varies very little with the filler content for a given system and degree of cure.
(c) The length of the plateau increases as the filler content increases.
(d) The tensile strength falls as the filler content rises, i.e., the "tail" becomes shorter.
(e) As the particle-size of the filler is increased at a given loading, the height of the plateau is reduced.
(f) As the modulus of the base stock is increased, the plateau rises.

As the filler content is progressively increased, the tensile strength will eventually fall to a value equivalent to the height of the plateau, and the elongation at break becomes indeterminate; the vulcanizate then is about to become brittle.

The suggested interpretation of these curves is as follows:

Over the steep initial portion of the curve the sampling is stretching largely as a whole; the filler particles are stuck to the rubber. At some stress the rubber begins to pull away from the filler particles (dewetting), and the softened rubber elongates; this process takes place along the plateau until the system resembles a sponge-rubber, with filler particles lying in the holes, but not adhering to the rubber. The plateau ends when the elongation of the sponge-like matrix is such that the same load as applied at the beginning of the plateau will produce no further elongation in the dewetted rubber. The "tail" then represents the further elongation of the sponge under increasing load until it finally breaks.

The increase in the initial slope with the filler content is the usual stiffening effect of fillers. It is reasonable to suppose that the stress at which the rubber-filler bonds break is independent of the filler content for a given system; hence the height of the beginning of the plateau is fixed. The more filler is present, the more tenuous is the sponge after dewetting, and so the higher the elongation corresponding to a given load, i.e., the lower is the modulus after dewetting. Similarly, the less rubber, the lower is the tensile strength of the sponge. The case of natural rubber is slightly different from that of the butadiene-copolymer synthetics in that crystallization can take place in the "tail."

The modulus of the base stock can be varied by altering the time of cure, and it is found that increasing the time

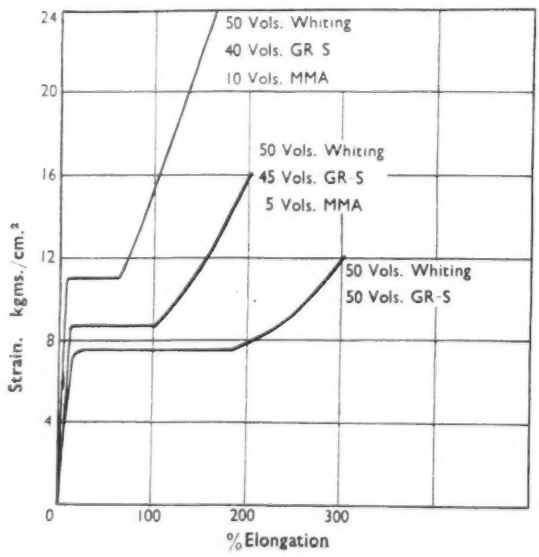


Fig. 6. Plateau raised by the addition of methyl methacrylate in pale crepe-whiting compound

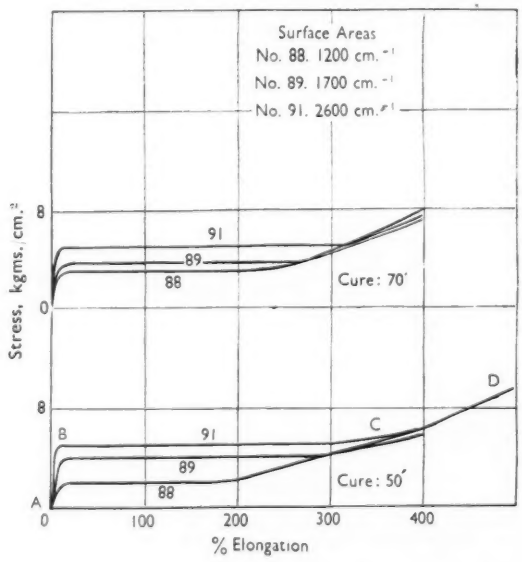


Fig. 7. Effect of particle size on stress-strain curve

of cure raises the plateau (Figure 4). Similarly, the height of the plateau is reduced by inclusion of softeners such as Cycline[4] oil or dibutyl phthalate (Figure 5), but the lowering of the tensile strength, in absolute units, is always greater than the lowering of the plateau. Consequently, a softened base stock will accept less filler before becoming brittle after curing than the original unsoftened material.

Again, increasing the modulus by the incorporation of carbon black, or by using rubber obtained from a latex in which methyl methacrylate had been polymerized, raises the plateau, and in addition with synthetics such as GR-S and Hycar OR-15 the height of the plateau and also the length of the "tail" can be increased by the addition of carbon black or methyl methacrylate (as above) (Figure 6) so that more non-carbon filler can be incorporated before brittleness is reached, though this is limited by the stiffness of the mix on the mixing rolls. With whiting and pale crepe it was found that of a range of wetting agents investigated, only cetyl pyridinium bromide had any definite effect, raising and shortening the plateau and increasing the tensile strength.

Decreasing the particle size of the filler increases the load at which the plateau appears (Figure 7), though in the range 10-50 $m\mu$ the effect is less marked than that of modulus. As shown below, this point indicates, in conformity with the observations of Jones and Yiengst,[5] that at a given elongation a higher fraction of large particles is dewetted than small ones. Thus at a given elongation, when approaching the plateau, and dewetting has commenced, the modulus of a small particle mix will be higher than that of a large particle mix. The modulus effect then raises the height of the plateau.

If the particle size is very small, as in the case of reinforcing carbon blacks, the plateau may not be observed though a practical limit is set here by the stiffness of the mix on the mixing mill.

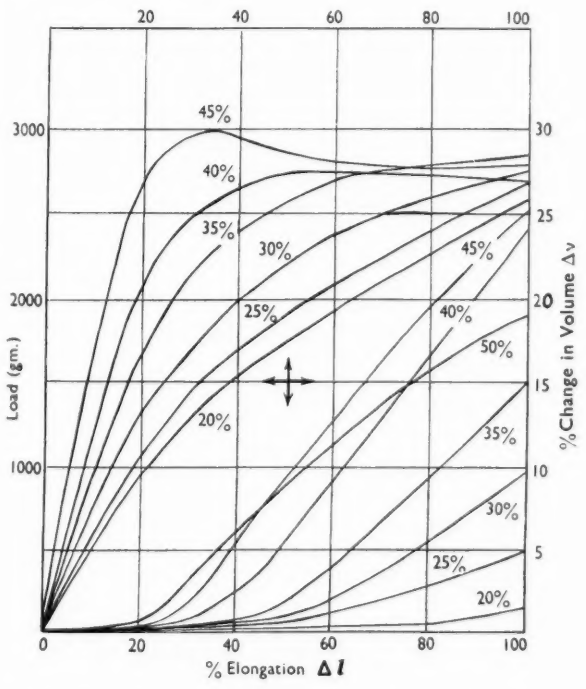


Fig. 8. Comparison of stress-strain and Δv-strain curves for whiting-pale crepe compound. Plateau corresponds to onset of steeper part of $\Delta v/\Delta l$ curve

Volume Changes on Elongation

In general, the findings of Jones and Yiengst[5] were confirmed, as extended to the systems whiting/pale crepe and whiting/GR-S, that increasing filler content led to an increased volume change (Δv) for a given elongation (Δl), and that small particles gave a smaller Δv than large ones.

In Figure 8 the $\Delta v/\Delta l$ curves and the stress/curves (measured on the B.R.P.R.A. modulus tester) are compared, and it is seen that the beginning of the plateau corresponds to the onset of the steeper part of the $\Delta v/\Delta l$ curve. It was also confirmed that when the stock was undercured, the $\Delta v/\Delta l$ curve lay below that for cure to the optimum of modulus, over the range tested. This result is due to the modulus of the rubber, since a small amount of carbon black or the addition, at low filler concentrations, of a wetting agent which increases the modulus of the specimen, produces an opposite effect.

This observed effect of modulus will also explain qualitatively why, with pale crepe/whiting vulcanizates, the 50% v/v $\Delta v/\Delta l$ curve crosses the 45 and 40% curves at elongations above about 50 and 75%, respectively, and the less marked effect with GR-S/whiting vulcanizates (Figure 9) where the curves begin to converge without crossing. When dewetting takes place along the plateau, the "knots" observed in the specimen correspond to undewetted portions of high modulus several times that of the gum stock network, which approximates to that of the dewetted portions. Hence, as the specimen is elongated, there are two opposing effects, firstly, the increase in volume due to increased dewetting, and secondly, the decrease in volume due to the change in modulus. As the elongation increases, the relative proportion of dewetted material increases, and so the $\Delta v/\ \Delta l$ curve bends over; the second effect finally predominates. The difference between the pale crepe and GR-S curves presumably arises from the higher modulus of the GR-S stocks at low elongations compared with pale crepe.

The finding of Jones and Yiengst that small particles gave smaller Δv at a given elongation and loading is confirmed by this work. The effects of particle size and modulus explain the effects of wetting agent in the whiting/pale

[4] Monsanto Chemical Co., St. Louis, Mo.
[5] H. C. Jones, Y. A. Yiengst, "Ind. Eng. Chem.," 32, 1354 (1940).

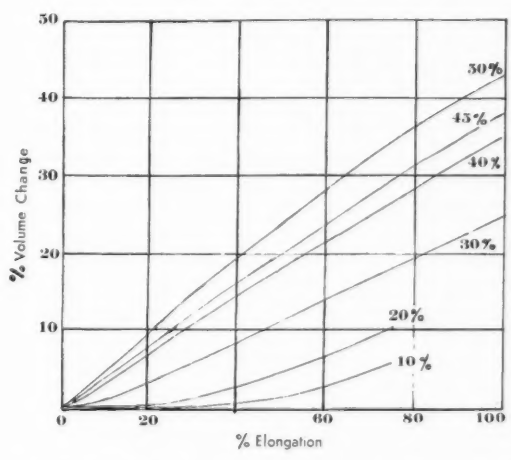


Fig. 9. Whiting in GR-S compound. Note that higher volume curves approach each other, but do not cross

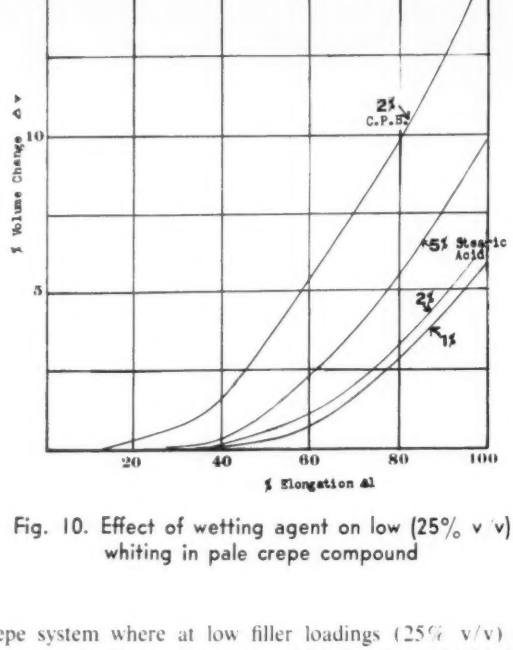


Fig. 10. Effect of wetting agent on low (25% v/v) whiting in pale crepe compound

crepe system where at low filler loadings (25% v/v) Δv is increased (Figure 10), and at high loadings (50%) it is decreased (Figure 11). At low filler loadings the modulus is increased, owing either to improved dispersion or increased filler rubber interaction, giving an increase in Δv; whereas at high filler loadings, where the dispersion will be poorer with many large aggregates, the action is to disperse the large aggregates, giving effectively, small particles instead of large.

Similarly, on maintaining at 100% elongation Δv increases at low filler concentrations owing to an increasing number of particles being dewetted; whereas at high loadings Δv decreases on standing because of the large change in modulus on dewetting (Figure 12). A suitable choice of filler content would give no volume change on standing although the tension drops markedly. The effect of repeated slow cyclic stressing, which leads to an increase in Δv at a given elongation at low filler concentrations, and a decrease after the first cycle with high loadings, is similarly explicable. With whiting/GR-S vulcanizates there is very little change in Δv on repeated cycling.

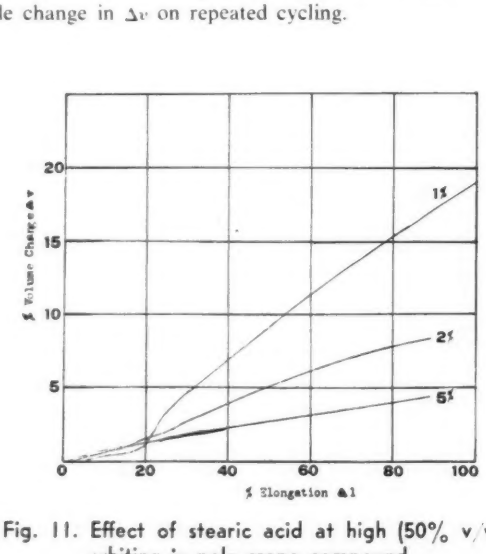


Fig. 11. Effect of stearic acid at high (50% v/v) whiting in pale crepe compound

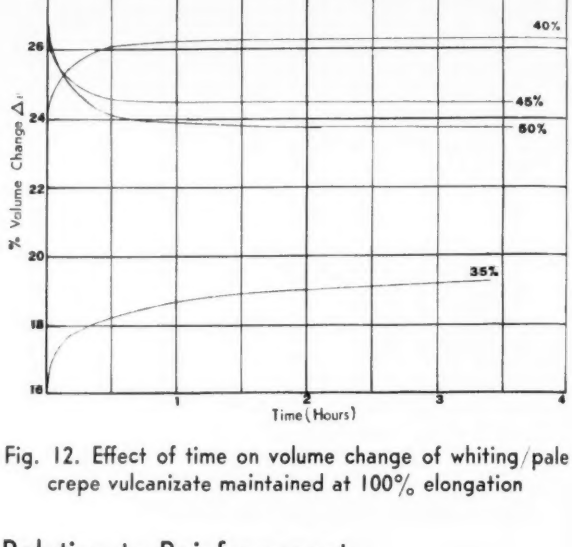


Fig. 12. Effect of time on volume change of whiting/pale crepe vulcanizate maintained at 100% elongation

Relation to Reinforcement

The stiffening action of a filler is not necessarily accompanied by reinforcement in the technological sense since the latter passes through an optimum as the filler content increases while the stiffness at low elongation increases continuously. It has been demonstrated with many fillers, and particularly with carbon black, that the reinforcing action increases, at a given loading, as the particle size decreases, when good dispersion is attained, though bad dispersion appears sometimes to obscure this. It seems very probable that there is a relation between reinforcing action and the ability of the filler to remain stuck to the rubber, particularly in the case of the butadiene-copolymer synthetic rubbers where the physical properties of the gum stock are very poor compared with natural rubber, and where there is no crystallization.

The results presented here indicate that low particle size and high modulus contribute to reduce dewetting, and the small reinforcing action of fillers on Butyl rubber may possibly be due to the very low modulus of the gum stock at low elongations, compared with natural rubber and the other synthetics. It is not necessary to conclude from this statement that the reinforcing properties of a filler should, at a given particle size, be independent of its chemical nature, for the interaction between rubber and filler will play a twofold part. Firstly, by analogy with the wetting of solids by liquids, a high filler-rubber interaction will increase the dispersion and reduce the tendency to flocculation; and, secondly, it implies that more work must be done to separate the rubber from the filler. This point is supported by the recently published data on the effect of heat treatment of carbon blacks without altering their size, where a modification of the surface alters the physical properties.

The results observed in the present work can be interpreted in terms of the work required for dewetting the filler particles.

Consider Figure 13 in which are shown two stress-strain curves for vulcanizates differing only in the particle-size of the filler. It is assumed that complete dewetting has taken place at the end of the plateau, and that, to a first approximation, the completely dewetted material has the same curve in each case.

The dotted line represents the curve which would be

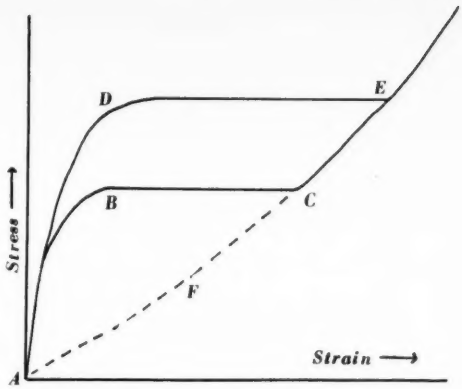


Fig. 13. Stress-strain curves for vulcanizates differing only in particle size of filler. Dotted line represents the curve which would be obtained on allowing specimens to retract from C or E

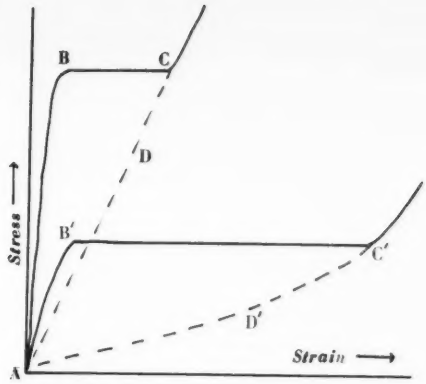


Fig. 14. Effect of modulus on same vulcanizate having different degrees of cure. Note, the higher the modulus the higher the plateau

obtained on allowing the specimens to retract from C or E. Then the energy required for dewetting is given by the areas ADEFA and ABCFA.

If the energy required to dewet unit area of the filler is roughly constant and independent of particle size, then more energy is required for the small-particle specimen, and so area ADEFA is greater than ABCFA, as observed.

Similarly, at a given elongation, it is seen that a larger fraction of the energy required for complete dewetting will have been expended with the large particles. This conclusion is confirmed by the observation of Jones and Yiengst that at a given elongation a larger percentage of large particles have visible vacuoles than with small particles.

The effect of modulus is shown in Figure 14, which shows the same mix with different degrees of cure. The energy required for complete dewetting is seen to be represented by the areas ABCDA and AB'C'D'A. Provided that the energy of dewetting is independent of the degree of cure, these areas should be equal; hence the higher the modulus the higher the plateau, as observed.

Experimental Verification of Modulus Equations

Previous work on filler reinforcement has fallen into two main categories: namely, the derivation and testing of equations relating the modulus of a filled rubber to its filler content[6] and technological work relating the usual criteria of reinforcement (tensile strength, abrasion resistance, and tear resistance) to specific properties of fillers, e.g., particle size.[7] In the light of the data presented here it is possible to lay down some conditions with which the experimental data to test the modulus equation should comply.

It is clearly important that the filler should be well dispersed in the rubber since inadequate dispersion leads to a lowering of modulus, either by a specific effect of particle size, or by dewetting of aggregates acting as large particles. Secondly, dewetting itself should be reduced to a minimum since, when it has occurred, the effective filler concentration is then less than stoichiometric. It seems common to most fillers that at low elongations the slope of the stress-strain curve is initially high and then decreases as the elongation increases, in contrast to the behavior of pale crepe vulcanizates; or if dewetting is not occurring, at a given elongation, the rubber between rigid filler particles must be at a higher elongation than the specimen itself; hence crystallization will appear at a lower apparent elongation. It therefore appears that the modulus should be measured at as low an elongation as can be accurately measured.

The practice of prestressing appears undesirable, and the criterion for lack of dewetting would be reversibility. It is well known that repeated stretching to high elongations has a very marked effect on modulus,[8] and while primary and secondary filler-rubber bonds have been postulated, it appears equally probable that, with very fine carbon blacks, the effects are due to the progressive dewetting of small aggregates; the dispersed individual particles remain stuck to the rubber.

Volume change and stress-strain measurements have indicated that with large particles more dewetting takes place than with small ones; hence to test the various equations a very fine particle filler should be used. Also, the stress decays with time in a filled specimen maintained under tension; the greatest rate of decay occurs in the first few seconds; the apparatus used by Guth[9] overcomes this objection.

It therefore appears that any experiments to test the theories should:

(a) Use small particles well dispersed.
(b) Measure stresses at very low elongation.
(c) Measure the stress immediately the elongation is reached.

We wish to thank G. S. Mills for his cooperation in the experimental work and P. D. Potts for many helpful discussions.

Reprints of "The Shrinkage of Mold Cured Elastomer Compositions," by Juve and Beatty, from our October, 1954, issue, are available at 10c each.

[6] A. M. Bueche, "J. Appl. Phys.", 23, 154 (1952).
[7] L. H. Cohan, India RUBBER WORLD, 117, 343 (1947).
[8] A. F. Blanchard, D. Parkinson, "Ind. Eng. Chem.," 44, 799 (1952).
[9] E. Guth, p. 353, in "Proceedings of the Second Rubber Technology Conference, 1948," W. Heffer & Sons, Ltd., Cambridge, England.

RUBBER WORLD

EDITORIALS

Tight U. S. Rubber Supply Situation in 1955?

According to at least two very good authorities on rubber supply and demand, the U. S. Department of Commerce and the Natural Rubber Bureau, the year 1955 may see a tight supply-demand situation on natural and synthetic rubbers in the United States, if the high level of consumption demand which began during the last half of 1954 is continued during the major part of 1955. Preliminary consumption figures for December, 1954, from The Rubber Manufacturers Association show 118,843 long tons of natural and synthetic rubbers used in that month, the highest monthly consumption figure since March and April of 1953. Consumption of GR-S, GR-I (Butyl), and natural rubbers was 52,493, 4,576, and 55,161 tons, respectively, in that month.

The Business & Defense Services Administration, U. S. Department of Commerce, in its December, 1954, issue of "Chemicals and Rubber," points out that if it were assumed that the disposal of the synthetic rubber producing facilities would result in a sale of only the capacity stated in the Disposal Act as a minimum for disposal, the annual tonnage available (500,000 tons of GR-S and 43,000 tons of Butyl) would not be adequate for the economic safety of the consuming industry. Industrial activity in the rubber industry in 1955 is expected to equal that of the peak 1953 year. The Disposal Commission reported on December 27 that it had actually signed contracts for the disposal of an annual capacity of 689,600 tons of GR-S and 90,000 tons of Butyl, but the Congress has the prerogatives of approving contracts to provide the minimum or contracted maximum tonnages, or rejecting enough contracts to make disposal impossible.

BDSA also pointed out that when a tight rubber supply situation develops, there are two main sources for relief, which are, increased output of GR-S and higher exports of rubber produced by smallholders in Indonesia. Increased supplies of Indonesian smallholder rubber, resulting from the higher prevailing price, were evident in the last half of 1954, and production of GR-S has been increased by the Federal Facilities Corp. from about 45,000 tons in December, to 54,500 tons for January and February, 61,000 for March, and 59,400 tons for April.

GR-S sales for Febuary, March, and April are estimated by FFC at 58,000, 66,000, and 69,000 tons, respectively, and although these figures include the oil content of oil-extended rubbers, they are several thousand tons in excess of the scheduled production for these months. Sales at this level will reduce the FFC's inventory of 57,000 tons on January 1, by more than 17,000 tons, and the net inventory at time of disposal in April will be less than one month's supply.

The Natural Rubber Bureau, in its January issue of *Natural Rubber News*, estimated the world net excess of natural and synthetic rubbers for 1954 at only 25,000 tons, and for 1955, at only 20,000 tons. This close supply-demand situation was said to be one of the basic reasons for today's rising price of natural rubber. We might add that other reasons are the lag in conversion from natural to synthetic rubber by the American consumer when the price of natural rose above 25¢ a pound last October and the lag in the natural rubber producing industry in meeting the increasing demand for its product which became evident in the last quarter of 1954.

The GR-S plants running at full capacity under government operation at present are capable of producing about 62,000 tons a month. Under the conditions of the Disposal Act, Congress may approve private industry capacity ranging between 40,000 and 60,000 tons a month. Another most important consideration here is that a GR-S demand level averaging 50,000 tons a month in 1955 would be unlikely to relieve the pressure that is keeping natural rubber prices about 35¢ a pound.

It becomes apparent, therefore, that approval by the Congress of all of the contracts negotiated by the Disposal Commission may be more important than previously realized. Even if increased natural rubber production is obtained, its price may not be appreciably lowered if conversion to GR-S is limited at too low a tonnage level.

R. G. Seaman

EDITOR

Meetings and Reports

Twenty-Four Papers Presented to Third Signal Corps Communication Wires and Cables Symposium

The Wire Communication Branch of the Coles Signal Laboratory, Signal Corps Engineering Laboratories, Fort Monmouth, N. J., held its third annual symposium on technical progress in communication wires and cables at the Berkeley-Carteret Hotel, Asbury Park, N. J., December 7-9. Twenty-four papers by industrial, governmental, and military specialists were presented to the 562 representatives of commercial and governmental organizations in attendance.

A welcoming address by Brig. General F. F. Uhrhane, Commanding General, Signal Corps Engineering Laboratories, opened the three-day conclave on Tuesday morning, December 7. Presiding, successively, over the morning and afternoon technical sessions were M. Tenzer, chief of Microwave Unit, Components & Materials Branch; W. R. Grueger, chief of Line Equipment Unit; H. F. X. Kingsley, chief of Wire & Cable Unit; H. G. Gold, chief of Cord & Cordage Unit; and H. L. Kitts, chief of Outside Plant Equipment Section. Major General G. I. Back, Chief Signal Officer, was the guest speaker at the Wednesday, December 8, banquet.

A wide range of subjects was covered in the technical addresses, and summaries of those of immediate or long-range interest to the rubber and plastic industries follow:

"The Effects of Soil Microorganisms on the Physical and Electrical Characteristics of Radio Frequency Cables." Alex Rogel, Signal Corps Engineering Laboratories.

Fungal degradation of plastic formulations is caused by plasticizer breakdown or actual utilization by the microorganism of the plasticizer in the protective jacket, although not all plasticizers are thus attacked. Mr. Rogel conducted his study with a variety of cable types and such plasticized coverings as chlorinated polyethylene and vinyl resin, as well as jackets of unpigmented, unplasticized nylon and polyethylene. The speaker reported that after 30 months of soil exposure he observed that the least fungus growth, and consequently the least electrical impairment, occurred on the jacketings of pigmented blue "Rulan" chlorinated polyethylene and on those of the unpigmented nylon. The pigmented black vinyl jacketing showed the most growth. Mr. Rogel concluded, however, that a 30-month period is not sufficient to impair seriously any of the materials tested.

"The Natural and Artificial Aging of Wire Jackets." Charles W. Hamilton, Robert I. Leininger, and G. M. L. Sommerman, all of Battelle Memorial Institute.

Although the authors were particularly concerned with nylon jackets, GR-S synthetic rubber, Perbunan-vinyl, and low-temperature vinyl materials were also tested. Ultra-violet light and heat were shown to be the principal factors affecting the degradation of nylon; the former caused cleavage of the molecule; the latter resulted in cross-linking with subsequent cleavage. GR-S and vinyl withstood both the natural and artificial aging tests better than did nylon, while Perbunan-vinyl failed the mandrel-wrap test after 6-9 months' exposure.

"Engineering Polyethylene for Wires and Cables." E. J. Burrough and E. E. Lewis, E. I. du Pont de Nemours & Co., Inc.

The chemical structure and preparation of polyethylene were discussed exhaustively by the authors. To achieve greater crystallinity and toughness, short-chain branching in the resin molecule was striven for, and the result was the development by du Pont of Alathon 3 and Alathon 5, both of high crystallinity and high molecular weight. Further improvements in this field were said to be forthcoming.

"Irrathene 201 Irradiated Polyethylene—a New Cable Insulation." P. A. Goodwin, General Electric Co.

In addition to offering all the advantages of conventional polyethylene material—low loss characteristics at all frequencies, high dielectric strength, excellent barrier to moisture, chemical inertness, low specific gravity, and good mechanical properties—Irrathene 201 can be used at high temperatures and is highly resistant to environmental stress cracking. Furthermore, it offers the possibility of encapsulation of conductors or various electrical devices to provide a homogeneous, watertight case of excellent properties.

"Quality Control of Vinyl and Polyethylene Electrical Insulating and Jacketing Materials." R. C. Boyd, Bakelite Co.

A quality control system consists of routine surveillance of three items: raw materials, process, and finished product. Discussing a vinyl insulating material consisting of vinyl chloride resin, ester plasticizer, calcium carbonate, clay, and lead stabilizer, the author outlined the process by which these raw materials are fabricated into a finished extrusion product, sketched in the properties of the component items and the final substance, and then detailed the system of control necessary to achieve this final substance.

"Kel-F Elastomer—a New Material for the Electrical Industry." M. E. Conroy and L. E. Robb, M. W. Kellogg Co.

This paper summarized the compounding and significant properties of this newly developed material as related to its potential application in the electrical industry. (A bulletin released by the company a month after the symposium expands on the authors' data and is covered separately on page 678 of this issue.)

"An Evaluation of Vinyl Hook-Up Wires." A. H. Lybeck and S. J. Trykowski, William Brand & Co., Inc.

This treatise evaluated three polyvinyl chloride insulation test compounds used for hook-up wire to determine their basic electrical, physical, and chemical properties; suitability for use throughout a range of operating temperatures; and the effect of high temperatures in particular on electrical and physical characteristics. The test compounds were William Brand products. Two of these, T-711 and T-740, are commercially available for JAN-C-76 and U/L 105° C. applications, respectively; the third, T-540, was specifically formulated to afford optimum performance throughout a wide temperature range. Among the test results reported, T-540 was said to have better retention of both dielectric strength and insulation resistance after aging in dry heat.

"The Application of Silicone Rubber Insulated Wires and Cables." L. B. Short, G-E.

Silicone rubber has a maximum operating temperature of 200° C. and is flexible down to —54° C., Mr. Short said. Special compounds, intended for limited service, have a maximum operating temperature of 300° C. and are flexible down to —85° C. At ordinary temperatures the tensile strength, elongation, and abrasion resistance of silicone rubbers are not so great as those of organic rubber, but performance at elevated temperatures is far superior. Silicone jackets for such wire applications as electronic hook-up, aircraft, ignition, fixture and appliance, refrigerator defroster, and heating, control and power cable were discussed.

"Cold GR-S Polymers for Wire Insulation." L. H. Howland, R. W. Brown, C. W. Lawson, all of Naugatuck Chemical Division of United States Rubber Co.

Several cold GR-S polymers were prepared experimentally and tested for use as insulating and jacketing materials for wire. Three of these have reached the production stage, and it was noted that the improvements of cold over hot GR-S, while not so great as in tire tread stocks, have still been sufficient to have caused a change from the hot to the cold types in about 50% of wire insulation polymer production. These cold polymers are non-staining and non-discoloring on aging in sunlight, and they contain Polygard, a powerful non-staining stabilizer for GR-S. Of various butadiene-styrene compositions, three are designated as general-purpose wire polymer, polymer for low-temperature service, and oil-extended polymer. Compounding, properties, and test data were items covered in this discussion.

"Butyl Polymer Compounding for Insulation." Emil W. Schwartz, Southern Clays, Inc.

Butyl polymer is an excellent dielectric, Mr. Schwartz said, in that compounds made of it give unusual aging, a fine degree of heat resistance, and excellent stability with regard to insulation resistance, dielectric constant, and power factor in dry or wet locations. In fact, he added, Butyl compounds, when properly mixed and processed, have the lowest water absorption of any vulcanizable polymer. He went on to outline standard base formulations, methods of mixing and accelerating these formulations, and results obtained by following these procedures.

"Butyl Insulation." W. C. Smith, Standard Oil Development Co.

Among the subjects covered in this lengthy and near-definitive report on Butyl insulation were processing of the material to give smooth, non-swollen extrusions; properties of quinoid cures, including a discussion of ozone resistance, heat aging, and electrical properties and stability; properties of sulfur cures; and jacketing. Exhaustive tables of data were presented to delineate Mr. Smith's text. As for application, Butyl jacketing was shown to be inherently not adaptable for uses where oil and flame resistance were imperative, but many other applications were in evidence where these requirements were not necessary, and good physical properties and resistance to wear and weather were sufficient.

"The Effects of Conductor Temperature on the Quality of Extruded Vinyl Wire Insulation." E. E. Griesser and M. M. Suba, Bakelite Co.

The effects of conductor preheating and other variables on the quality of extruded vinyl wire coatings were discussed, and their importance emphasized. Heat shock failures were said to be capable of being overcome by extruding the compound at an optimum temperature or hotter.

"Specification Changes and New Developments in Cable and Wire for the Rural Electrification Administration." W. T. Smith, C. R. Ballard, and A. L. Richey, all of the Rural Electrification Administration.

Although open wire provides the least expensive means of serving the low-density rural areas, there is a substantial demand for aerial cable, as evidenced by the current $4.4 million investment in it, of which $1.5 million is plastic insulated and jacketed wire. Accordingly, the authors discussed the latest changes in REA's specification PE-14 which covers minimum standards for such plastic insulated cable for use in REA-financed telephone plants, and includes altered specifications for shields, capacitance unbalance, dielectric strength, splicing, and cable accessories.

"A Resin-Sealed Approach to Communications Splicing." E. W. Bollmeier, Minnesota Mining & Mfg. Co.

The results of an investigation of cable splicing techniques using epoxy thermosetting plastic resins as insulating and sealing materials were reported. A comparatively recent innovation, the technique has enjoyed excellent field results with telephone cables. Mr. Bollmeier discussed three kinds of splices: the openable, reopenable, and solid splice. He expressed the opinion that these splices combine the better properties of mechanical closures and liquid epoxy resin into a result impossible to obtain with either alone.

U.S.A. Papers at November 26 Stockholm Meeting

In addition to the paper on carbon blacks given before the meeting of the Swedish Institution of Rubber Technology in Stockholm, Sweden, November 26, by I. Drogin, United Carbon Co., and reported on page 514 of our January issue, four more papers by authors from American carbon black companies were presented. C. W. Sweitzer, Columbian Carbon Co.; L. D. Carver, Witco Chemical Co., and R. A. Reinke, Witco-Continental Carbon Co.; Harry J. Collyer, Cabot Carbon, Ltd. (associated English company of Godfrey L. Cabot, Inc.); and Jan Willums, Phillips Chemical Co., were the authors of these papers.

Dr. Sweitzer in his paper, **"The Role of Carbon Structure in the Reinforcement of Rubber,"** reviewed the work that had been done in the development of the present concept of carbon structure until at the present time carbon structure is rated second only to particle size or surface as the most important property of carbon black influencing rubber reinforcement. Carbon structure has been shown to be present in all carbon blacks in varying degree; the persistence of this structure determines its ultimate role in rubber. The fragile type of structure inherent at the time of manufacture is largely lost in the processing of the dry black; while the more permanent structure largely persists during processing in rubber, it was said. Carbon structure in rubber compounds has been shown to have a significant effect in stiffening rubber. Associated beneficial effects include improved extrusion, abrasion, and in case of tread carbons greater road wear also. Carbon structure is the most effective and economical means of securing viscosity and extrusion benefits in rubber with the minimum penalty of hysteresis, it was concluded.

Carver and Reinke's paper, presented by J. A. White, of Witco's London office, was entitled **"The Influence of Pelletizing and Packaging on the Dispersibility of Carbon Blacks."** The preparation of dry and wet pelletized blacks was explained, and it was added that the uniformity of black produced by pelletization assures good dispersion of the black when used in the Banbury mixer in properly proportioned rubber compounds under correct mixing cycles.

By compressing pelletized black a reduction of 20% in volume may be obtained. This new method of packaging for export introduces savings in ocean freight costs and storage space and provides for easier handling of carbon black. Compressed blacks are mixed in natural rubber at high speed in a Banbury mixer, and this procedure will assure good dispersion. For oil-extended and LTP GR-S compounds, masterbatching of the black is recommended.

In the paper by Mr. Collyer on **"Non-Staining Carbon Blacks,"** it was pointed out that carbon black, by nature, must be black, but, properly chosen and used, it need not contribute to staining and in fact may be helpful in suppressing stain caused by other compounding ingredients. Both contact and migration stain tests were run with SRF, FF, HMF, FEF, HAF, and EPC blacks at loadings from 10 to 80 parts. The contact stains diminished as loading was increased, and none of the blacks tested imparted stain of greater intensity than that of the control compound which contained no black. In the migration stain tests it was reported that discoloration of the white face stock is influenced by the type of black in the backing compound and that HAF black in the rosin oil carcass compound caused less discoloration than that displayed by the unbacked compound, and to a lesser extent this occurred with HMF and the non-staining SRF black also. HAF black also minimized the staining tendency of the pine-tar compound, and FF and EPC blacks were nearly as good. FEF black was less effective than HAF or EPC blacks in cleaning up discoloration from other compounding ingredients.

Mr. Willums discussed **"Types of Carbon Blacks—Manufacturing Processes and General Properties"** in his paper. The channel, thermal, and furnace processes for the manufacture of carbon blacks were described, and the advantages of the oil furnace process as compared to the channel process with special reference to raw material availability, yields, and properties of the finished products were listed. A general review of the properties of the various carbon blacks covering particle size, surface area, oxygen and hydrogen content, and structure concluded this paper.

Tlargi Holds Question-and-Answer Symposium on Accelerators

The Los Angeles Rubber Group, Inc., held a question-and-answer symposium on accelerators, November 3, during which a six-member guest panel responded to pertinent queries submitted in writing by members. Presided over by J. W. Wechselberger, Jr., Plastic & Rubber Products Co., the panel consisted of William A. Fairclough, Naugatuck Chemical Division of United States Rubber Co.; Herman J. Jordan, E. I. du Pont de Nemours & Co., Inc.; B. S. Garvey, Jr., Sharples Chemicals, Inc.; A. R. Davis, American Cyanamid Co.; B. R. Snyder, R. T. Vanderbilt Co.; and M. C. Throdahl, Monsanto Chemical Co.

The record of this symposium follows:

Q. What accelerator combination will provide the best compression set of GR-I compounds?

A. Fairclough. Relatively little information is available on compression set in GR-I (Butyl). As in other rubbers, lowering sulfur and increasing ultra-accelerators improve compression set values. A good combination is 1.5 PHR sulfur, 1.5 PHR tetramethyl thiuram disulfide, 0.5 PHR mercaptobenzothiazole, and either Tellurac[1] or Tonox[2] or both. Lowering sulfur to 0.75 or 1.0 PHR and increasing the thiuram to 2-3 PHR might very well improve compression set while also improving scorch safety. Certain Polyac[3] combinations show good compression set values, but scorch characteristics are generally not good.

Q. What is the best accelerator for Neoprene Type W?[4] Permalux[3] seems too slow and NA-22[3] too fast.

A. Jordan. I find that it is the consensus of opinion that NA-22 is the best available material in terms of cure vulcanizate properties for Neoprene Type W. In nearly all cases it produces a higher state of cure and is significantly better aging than any other material. Permalux is both weaker and more expensive to use, but is often quite effective, particularly with black stocks. Permalux is also more susceptible to the influence of other compounding ingredients than is NA-22. This characteristic may be an advantage or a disadvantage, depending on conditions. It is possible, for instance, to speed up the rate of cure in the presence of Permalux by increasing the ratio of zinc oxide to magnesia. By decreasing this ratio a slower cure rate is produced which, nevertheless, often produces an adequate state of cure.

The use of thiuram-guanidine-sulfur combination, such as 0.5% of Thionex[3] and 0.5% of DOTG with 1% of sulfur, has been demonstrated to have a relatively fast rate of cure with good processing safety. Although, from a standpoint of best aging resistance and resistance to compression set at high temperatures, particularly in very bright colors, the use of straight NA-22 is our best recommendation. It is more scorchy than the thiuram-guanidine-sulfur combination, however, and a compromise may be reached by the use of NA-22 as a supplementary accelerator to this combination without a serious sacrifice in processing safety.

When water resistant compounds are involved, a combination of red lead with 1% or 2% Thionex produces safe processing stocks with a high state of cure. This acceleration is discussed in du Pont Rubber Chemicals Bulletin 265.

Q. Would you discuss the use of accelerator masterbatches for accuracy in weighing and better dispersion?

A. Garvey. The use of accelerator masterbatches increases the accuracy of weighing. This point is illustrated by assuming an accuracy of say ± 10 grams in the balance. Ten grams is 20% of 50 grams of accelerator, but is only 4% of 250 grams of a 20% accelerator masterbatch. Masterbatches make it easier to get good accelerator dispersion, but they do not eliminate the need of good and careful mixing.

Q. Would you discuss the deterioration of accelerators in uncured stocks?

A. Garvey. I assume you do not refer to scorching, but to actual accelerator decomposition. Under such extreme conditions as storage for 6-24 months at temperatures which may reach 140° F. or processing which may involve times of 5-30 minutes at temperatures of 280-360° F. after accelerator addition, some accelerators may partly decompose.

The effect depends on the type of decomposition. For example, some MBT derivatives may break down to MBT or MBTS and some amino compound. A volatile amine will evaporate from the batch, and the net effect will be a loss of accelerating power. On the other hand, if the activating amine end is not lost, the net effect is increased scorchiness because the two parts of the accelerator activate each other after separation more than they do when they are chemically combined. In some cases an accelerator may completely decompose and lose all of its accelerating activity.

In general, the really unstable accelerators are no longer on the market except as specialties. However, where the uncured gum may be stored for a long time, as in camelback, the possibility of deterioration should be checked. Masterbatches should be stored under favorable conditions, and the possibility of deterioration checked. Similar precautions should be observed if the compound containing the accelerator may be subjected to excessive heat in processing.

A. Jordan. The term deterioration may be an unwise one to use in this connection since there is little or no evidence of any real chemical deterioration of accelerators under normal conditions. It is well known, however, that some stocks will lose curing activity on prolonged bin storage. This tendency appears to vary between various types of elastomers. For example, in general it is somewhat more pronounced in GR-S stocks than it is in natural rubber stocks. It will also vary, depending upon type and amount of filler which is used.

Q. What is the best combination of accelerators to use with nitrile type rubbers without sulfur to get heat resistant non-blooming stocks?

A. Fairclough. One and one-half PHR dipentamethylene thiuram tetrasulfide (Tetrone A)[3] and 1.5 PHR benzothiazyl disulfide are a good non-blooming but somewhat scorchy combination. One and one-half PHR tetramethyl thiuram disulfide, 1.5 PHR benzothiazyl disulfide, 0.4 PHR sulfur result in equally good heat resistance, are non-blooming and less scorchy. Further scorch improvement in the latter combination is possible with the addition of one part of specially treated phthalic anhydride (ESEN).[2]

A. Garvey. We prefer mixtures of equal parts of the tetramethyl and tetraethyl thiuram disulfides or their partial replacement by Vultac.[4]

Q. What is the best combination for stable low-temperature curing of Butyl compounds; also for two-part air-cure Butyl cements?

A. Fairclough. This question must be answered in generalities since the terms "stable" and "low temperature" are not defined.

(a) The combination of 1.5 PHR tetramethyl thiuram disulfide, one PHR selenium diethyl dithiocarbamate, two PHR sulfur has been widely used in proofing cures from 260° F. up. It is very stable in solution.

(b) The combination of two PHR paraquinone dioxime (GMF),[2] four PHR benzothiazyl disulfide, 1.5 PHR sulfur in non-black stocks has good stability and has greater activity than (a).

Air curing two-part Butyl cements may be made with GMF activated with either lead dioxide or Dactin.[3] Fillers and other compound variations have marked effects on stability and activity of the quinone dioxime cures.

Q. What is a safe accelerator to use in nitrile rubber cements that must have a shelf life of at least three months?

A. Davis. The storage life of nitrile rubber cements depends on a number of factors including the composition of the stock from which the cement is made and may also involve the stability of the polymer itself. The choice of accelerator will depend upon the temperature at which it is desired to cure the cement film. Benzothiazyl disulfide (MBTS) is the safest accelerator for nitrile rubber stocks to be cured at normal curing temperatures (285-320° F.). In nitrile rubber stocks with furnace black we have found MBTS to be less scorchy (or safer processing) than the delayed-action accelerators of the sulfenamide type which show more delayed action than MBTS in natural rubber-furnace black stocks.

Q. What is the most economical acceleration for GR-S general molded goods?

A. Garvey. I think that for this type of stock the most economical acceleration is a thiuram. Tetraethyl thiuram disulfide is one of the best.

A. Davis. The most economical acceleration for GR-S general molded goods depends, of course, on many factors such as composition (fillers and reinforcing agents, etc.) of the stock, processing and curing

[1] R. T. Vanderbilt Co., Inc., New York, N. Y.
[2] Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.
[3] E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
[4] Sharples Chemicals, Inc., Philadelphia, Pa.

conditions. The cheapest accelerator combination on paper from the dollars and cents standpoint might not be the most economical under all conditions. In general, benzothiazyl disulfide (MBTS) in combinations with the guanidines (such as DPG) gives safe and low-cost acceleration for GR-S stocks. In the case of some GR-S furnace black stocks a combination of MBTS (0.25%) plus tetramethyl thiuram monosulfide (0.25%) gives very low-cost acceleration.

Q. What is the recommended acceleration for natural rubber, 90 Shore hardness stock loaded with MT black, for best compression set and aging?

A. Fairclough. Best compression set and aging in a natural rubber compound will result with a combination of three PHR tetramethyl thiuram disulfide and one PHR benzothiazyl disulfide.

A. Snyder. I would suggest a sulfurless cure of approximately 3% tetramethyl thiuram disulfide with approximately 2% of benzothiazyl disulfide. It may be desirable to use from 0.25% to 0.50% of sulfur or possibly selenium to tighten up the cure and improve compression set. Both sulfur and selenium will hurt the aging properties, but I believe selenium will do much less harm in this respect.

Q. Which acceleration will produce the least brittle hard rubber at the same hardness? Also, in thick hard rubber, which acceleration will cure the fastest without blowing?

A. Jordan. Direct laboratory tests which will give an unequivocal answer to these two questions are not available. However, the widespread use of aldehydeamines, such as, for example, Accelerator 808[3] in the commercial production of hard rubber, shows that industry has been able to use this type of acceleration successfully. Under proper factory conditions, using Accelerator 808, many pounds of high-quality hard rubber having good elongation (freedom from extreme brittleness) and freedom from porosity (indication of blowing) have been produced. Some manufacturers have reported excellent results in these respects with guanidine or thiuram acceleration using such accelerators as DOTG and Thionex, but aldehydeamines appear to have been used most generally.

Q. How would you accelerate a high nitrile content rubber for high-temperature resistance (300-400° F.)?

A. Fairclough. Nitrile rubbers can be recommended for only limited service at 300-400° F. The most widely applicable acceleration for best heat resistance is 3-3.5 PHR tetramethyl thiuram disulfide, three PHR benzothiazyl disulfide with up to 0.25 PHR sulfur or up to 0.5 PHR morpholine disulfide for improved cure state and compression set. Provided the sulfur is dispersed properly (preferably early in the mix), no sacrifice in heat resistance results. Naturally, loading and other factors determine the exact acceleration balance.

Q. What acceleration would you recommend for a 50-50 blend of natural rubber and GR-S?

A. Garvey. Probably the best kind of acceleration for these blends is an activated thiazole type such as: (1) MBTS-thiuram, (2) MBTS-DPG, (3) Santocure,[5] (4) NOBS,[6] (5) Ethylac.[4] It is often advantageous to use 2-3 PHR of Vultac with 1.5 to 2.25 PHR of sulfur.

A. Snyder. I suggest approximately 0.50 PHR of benzothiazyl disulfide and roughly 0.25 PHR of an ultra-accelerator such as tetramethyl thiuram monosulfide, zinc dimethyl dithiocarbamate, etc., along with 2-2.25 PHR of sulfur. If cost is a serious factor, approximately 0.30 PHR of benzothiazyl disulfide and an equal amount of the ultra-accelerator could be considered along with sulfur of 2-2.50 PHR.

A. Davis. Here again the choice of acceleration depends upon a number of factors including the fillers and reinforcing materials used in the stock. Benzothiazyl disulfide (MBTS) in combination with guanidines (DPG, etc.) or with tetramethyl thiuram monosulfide has given good results. In the case of natural rubber GR-S blends with reinforcing furnace blacks, good results have been obtained with the benzothiazole-2-sulfenamide-type accelerators.

Q. Will cure rates of each polymer mentioned in the preceding question be equal?

A. Garvey. The cure rates of the two polymers with the same acceleration will not be equal. That for GR-S is slower. Vultac increases the rate of cure for GR-S, but not for natural rubber and thus brings the two closer together. This is sometimes a real advantage.

A. Snyder. I believe that if the two polymers are sufficiently blended, a homogeneous mass will result, and that this mass will vulcanize at a consistent rate.

A. Davis. The cure rates of each polymer are not likely to be the same, but the natural rubber appears to have a plateau of cure broad enough to enable the GR-S to reach a good state of cure before the natural rubber becomes seriously overcured.

Q. Would you explain curing action of regular and ultra-accelerators and give applications of the two types?

A. Garvey. I interpreted this question in terms of compounding. Looking at it this way, the distinction between regular and ultra-accelerators is strictly one of acceleration and will depend on scorch time (the time before cure starts), vulcanization time (the time after vulcanization starts to reach a technical cure), and the temperature coefficients of these two portions of the cure curve. There is considerable evidence that if we chart the temperature coefficient against the temperature, nearly all accelerators will show a break in the curve somewhere between 100 and 300° F. If this break is sharp, it shows what is sometimes called the "trigger temperature" of the accelerator or the temperature at which it becomes active.

At the ultra-accelerator end we find those accelerators with a low activation temperature, a short scorch time, and a short vulcanization time. At the regular accelerator end we would have those with a high temperature of activation, a long scorch time, and a long vulcanization time. Actually all sorts of combinations of these characteristics are available, and there is no sharp dividing line between the classes.

Many people refer to the thiurams and dithiocarbamates as ultra-accelerators and the guanidines and thiazoles as regular accelerators. However, by the above classification there is overlapping both ways.

A. Throdahl. It appears that the function of an accelerator is to catalyze formation of sulfur radicals at different rates in the presence of fatty acids and metal salts. The actual mechanism of accelerator reaction with other compounding ingredients is imperfectly understood, but ideally it is thought that monosulfide or disulfide linkages between carbon chains are the final desired end-products of the accelerator-sulfur reaction system. The effect of certain built-in structural groups is to alter the rate at which such reactions take place.

For example, mercaptobenzothiazole, a compound typical of a regular accelerator, is thought to give an initial reaction product (in the presence of sulfur) of the zinc mercaptide of mercaptobenzothiazole. Under conditions of low concentration of mercaptobenzothiazole no zinc mercaptide is found except initially and near the end of the vulcanization reaction. This suggests that the zinc mercaptide of mercaptobenzothiazole reacts as rapidly as it is formed to regenerate mercaptobenzothiazole itself. Since two hydrogen atoms are necessary to convert the zinc mercaptide to the corresponding mercaptobenzothiazole, these atoms must come from the rubber. The "activated" rubber will then react directly with sulfur radicals.

On the other hand, a compound such as tetramethyl thiuram disulfide, typical of an ultra-accelerator, reacts in the presence of sulfur and heat to give a

N—S—S free radical and sulfur. This

free radical further reacts with elemental sulfur in a series of stepwise reactions to yield a number of sulfur radicals which then can react directly with the rubber hydrocarbon on the alpha carbon atoms.

Q. What is a non-staining combination to cure 50/50 GR-S Smoked Sheet combination stock 10 minutes at 297° F. and maintain 14-16 minute T_8 250° Mooney?

A. Garvey.

Sulfur	2.25	1.75
Vultac #2	2.00	2.00
Ethylac	0.70	1.00

A. Davis. We have no specific recommendations for this since the acceleration will depend, to a great extent, upon the fillers and reinforcing pigments used in the stock. We would expect, however, that the requirements might be met by a combination of tetramethyl thiuram monosulfide and MBTS. Under some conditions the thiuram monosulfide alone might be satisfactory.

Q. What are the methods of chemical analysis for mixtures of Altax[1] and Santocure?

A. Throdahl. Mixtures of Altax and Santocure may be separated by solution in diethyl ether. The solubility of Altax in ethyl ether is only 0.06-gram per 100 cubic centimeters at 25° C. This represents a negative error of not more than 0.5% of the percentage of Altax which is found as the other insoluble portion of a 10% solution of Santocure and ethyl ether. Two

[3] Monsanto Chemical Co., Akron, O.
[4] American Cyanamid Co., Intermediate and rubber chemicals department, Bound Brook, N. J.

other factors tend to reduce the negative error:

(a) Owing to the evaporation of the ether during extraction, the temperature of the solution is considerably below 25° C.

(b) Altax is extracted from Santocure for only 10 minutes or so.

Separation of Altax and Santocure mixtures may also be done by use of ultra-violet technique, although the absorption of both Santocure and Altax by ultra-violet occurs in the same wave length. The lack of interference results from the apparent insolubility of Altax in methanol. Although Altax is soluble to about the same extent in methanol as in ethyl ether, it does not have time to become anywhere near completely dissolved. The maximum error introduced in the Santocure result by presence of Altax (regardless of the amount present) is about 0.5%.

Q. Do retarders have a place with furnace black stocks, or can a delayed-action accelerator or lower acceleration provide a better solution?

A. Snyder. I believe that by properly accelerating a stock, which would include the proper selection of accelerators along with the necessary amounts of each, a delayed-action acceleration system can result which will eliminate the need of any retarder. Retarders are generally excellent expedients for delayed action; however, their use does not always allow for the most economical acceleration.

A. Davis. In general, the available retarders, even when used in substantial ratios (0.5 to 0.75 PHR) with furnace black, extend the scorch time or processing safety only a few minutes and then at a decided increase in cost. In the long run it seems more desirable to select the acceleration with the necessary delayed action to give the desired processing safety for the given furnace black stock.

Q. Would you compare heat resistance of straight Vandex[1] or Telloy[1] cure for nitrile rubber with "normal cures" such as Altax-sulfur?

A. Snyder. I am not sure that I understand exactly what is meant by a straight selenium or tellurium cure. If it is intended that these materials be used in place of other accelerators and sulfur, I do not believe a satisfactory vulcanizing system would result, and it certainly would not be a practical vulcanizing system from an economical standpoint. If it is intended that tellurium or selenium be used as a "kicker" for the cure in a sulfurless curing system, I believe good heat resistance would result. Generally superior heat resistance is obtained by using small amounts of selenium or tellurium in preference to small amounts of sulfur. In natural rubber tellurium, and to some extent selenium, has a tendency to prevent reversion caused by severe overcure and/or severe heat aging. Indications are this might be true in the case of nitrile rubber; however, I have seen no definite proof of this in the way of laboratory data.

More Group Parties

Chicago Group Fetes Noel

Some 850 members and guests of the Chicago Rubber Group attended the organization's annual Christmas Party and Ladies' Night at the Morrison Hotel, Chicago, Ill., December 17. The program consisted of a cocktail hour, dinner, a full entertainment bill of TV and nightclub acts, dancing, and the distribution of necklace-and-earring sets to the women present.

Frank E. Smith, Williams-Bowman Rubber Co., was chairman of the committee in charge of arrangements, and John F. Swart, of Van Cleef Bros., division of Johns-Manville Corp., was vice chairman. Other committee members included Maurice J. O'Connor, O'Connor & Choate; Grant E. Sweet, Williams-Bowman; John D. Saunier, General Electric Co.; John J. Lawless, E. I. du Pont de Nemours & Co., Inc.; George Smith, Williams-Bowman; William Urbanek, Dryden Rubber Division of Sheller Mfg. Co.; and Gerry G. Kraft, Kraft Chemical Co.

Buffalo Group Officers

The Buffalo Rubber Group held its annual Christmas Party at the Buffalo Trap & Field Club, Williamsville, N. Y., December 8, with 160 members and guests attending.

Charles Johnson, Hewitt-Robins, Inc., was elected chairman for the coming year, and Paul Schwert, Dunlop Tire & Rubber Co., was chosen vice chairman. Also elected were Charles Wahl, Hewitt-Robins, secretary; and Norman Fleischman, Buffalo Weaving & Belting Co., E. Schutz, Dunlop, and Jean Nesbit, Jr., U. S. Rubber Reclaiming Co., members of the executive committee.

N. C. R. G. Celebration

The twelfth annual Christmas party of the Northern California Rubber Group was held December 18 at the Oakland Willows, Oakland, Calif., with 125 members and guests in attendance. Door prizes and gifts to the women present were distributed. Dancing continued until 1:00 a.m.

Chairman of the event was L. Evans, Mansfield Tire & Rubber Co. Other committee members included C. Ashcroft, B. E. Dougherty Co.; Miss Ruth Hatch, Mansfield Tire; Stanley Mason, Quaker Rubber Co.; and Mr. and Mrs. J. Elwood, Monsanto Chemical Co.

The Group's newly elected officers were introduced by Fred Swain, formerly of Pioneer Rubber Co. They consisted of Halsey Burke, Burke Rubber Co., president; Leonard Evans, Mansfield Rubber Co., vice president; Eugene Gador, Oliver Tire & Rubber Co., secretary; Mr. Mason, treasurer; and Claude Corkadel, Oliver Tire, Drace Kutnewsky, Burke Rubber, and Ralph Hickox, Goodyear Tire & Rubber Co., board of directors.

Gerrie Discusses Shaw Intermix

R. D. Gerrie, general manager of the Burlington, Canada, plant of Francis Shaw & Co., Ltd., Manchester, England, discussed his company's Intermix Machine during the business session of the December 14 meeting of the Ontario Rubber Section, Chemical Institute of Canada, at the Collins Hotel, Dundas, Ont., Canada.

Similar to the Banbury mixer, the Intermix was said to be more advantageous in some respects, including the permitting of batch dumping at 30-40° F. cooler than the Banbury; the elimination of excessive wear on the rotors by the two-piece rotor design; and the reduction of wall wear because of the rotor and mixing chamber design which permits more mixing to be done between the two rotors.

W. J. Nichol, Gutta Percha & Rubber, Ltd., introduced Mr. Gerrie.

Christmas door prizes were won by Gerry Ray, Canadian Resinous Products; Harold Green, Dominion Rubber; Al Crapper, Canadian Titanium Pigments; and T. Smith, Firestone Tire & Rubber Co.

Ontario Group Hears Rowzee

E. Ralph Rowzee, president of the Chemical Institute of Canada, and vice president and manager of Polymer Corp., Ltd., Sarnia, addressed the Ontario Rubber Section, C.I.C., meeting in Toronto, January 13, on the subject of "Rubber, Old and New." He discussed the current situation of both natural and synthetic rubber.

Basing his knowledge of the natural rubber scene on his trip to the Far East in the spring of 1954, Mr. Rowzee analyzed the economies of Ceylon, Malaya, and Indonesia, the principal rubber producing areas. Optimistic in the main, he emphasized, however, the necessity of replanting the rubber acreage in the East if production is to be maintained at present or future levels, a step also strongly suggested at the International Rubber Study Group meeting in Ceylon.

Tied in, of course, with the natural rubber situation is the expanding use of synthetics, an expansion, he said, that would reach 50% of total rubber consumption in five to ten years. He outlined developments in synthetics since the war, such as cold rubber and oil-extended rubber, Vulcollan, Chemigum SL, and Alfin rubber, and pointed to these developments as proof of his contention that synthetics can be produced more economically in North America than anywhere else.

Rubber Division, A. C. S., Detroit Meeting

The spring meeting of the Division of Rubber Chemistry, A. C. S., will be held at the Sheraton Cadillac Hotel, Detroit,

(Continued on page 700)

NEWS of the MONTH

Washington Report and National News Summary

The long-awaited report of the Rubber Facilities Disposal Commission to the Congress was made public on January 24 and showed that contracts had been signed for the sale of 24 plants at a price estimated to be $285,465,000. With the return from the sale of the inventory of synthetic rubber at transfer date this figure increases to $310,565,000, and with the estimated cash on hand at this same estimated transfer date of April 30, 1955, the government stands to obtain $401,565,000.

The Commission stated that it felt that the requirements of the Disposal Act of 1953 had been achieved with regard to such important factors as national security, competition, full fair value, patents, and research.

The President's budget message issued earlier in January indicated that the net profit for the synthetic rubber program for the year ending June 30, 1955, would be about $36 million. In fiscal 1956, with disposal of the plants to private industry, a net loss of $3.38 million is anticipated.

Although disposal of the minimum synthetic rubber producing capacity tonnage required by law of 500,000 tons of GR-S and 43,000 tons of Butyl would satisfy national security requirements, it would not be likely to satisfy 1955 requirements of the consuming industry, according to the Business & Defense Services Administration, United States Department of Commerce.

The Natural Rubber Bureau meanwhile pointed to the small world excess of natural and synthetic rubbers estimated for 1954 and 1955 and suggested that this close supply situation was one of the basic reasons for today's rising price of natural rubber.

John L. Collyer, chairman of the board, The B. F. Goodrich Co., proposed that the government dispose of natural rubber in the stockpile in excess of the tonnage required for a national emergency. A review of our natural rubber stockpiling policy is in process.

The second increase in two months in tire prices was announced.

Washington Report

By ARTHUR J. KRAFT

Disposal Commission Recommends Sale of 24 Plants for $285,465,000; Disposal Act Requirements Held Met

The Rubber Producing Facilities Disposal Commission released its "Report to Congress—Recommending Disposal of Government-Owned Synthetic Rubber Facilities," in Washington, on January 24. A supplement to the report contained the full text of all proposals received, basic forms of contracts of sale, and appendices of all contracts signed. The report itself totaled 47 pages with 17 pages of appendices. The supplement consisted of 241 pages.

Financial Aspects

The disposal program recommended to the Congress in accordance with Public Law 205 of the 83rd Congress by the commissioners, Holman D. Pettibone, chairman; Leslie R. Rounds, vice chairman; and Everett R. Cook, with the assistance of Eugene Holland, the executive director, consisted of contracts for the sale of 24 of the government-owned rubber producing facilities at a price estimated to be $285,465,000. Total sales price is presented as an estimate, it was said, because the sales contracts provide for the payment of a fixed sum plus an additional amount for the cost of net capital additions and the cost of inventory items, both as of the time of transfer. Because the latter two elements of sales price will not be definitely known until transfer time, the total realization can be only presented now as an estimate.

Under contract are 689,600 long tons of GR-S capacity and 90,000 long tons of Butyl capacity, both in excess of the statutory minimum of 500,000 and 43,000 long tons, respectively.

In a separate summary, the Commission reported that it "has executed contracts of sale for plants and equipment which, supplemented by cash expected to be realized from sale by the Federal Facilities Corp. of the government-owned inventory of synthetic rubber, will produce for the United States Treasury a total of approximately $310,565,000.

"This total is made up of the sum of the . . . items," listed in Table A.

It was added that the government will retain ownership of the copolymer plants at Institute, W. Va., and Baytown, Tex., and the alcohol butadiene plant at Louisville, Ky., the Akron, O., laboratory, tank cars, and miscellaneous equipment having, as of November 30, 1954, a gross book value of $64,556,138 and a net book value of $19,190,542.

National Security

With reference to the requirements of the Disposal Act regarding national security the Commission reported that all of the purchasers are responsible companies of substantial size and almost all of them have operated defense plants for the government. The purchasers can be expected to continue the facilities in operation because it is economically sound to

TABLE A

"(1) Contract sales prices of 24 plants which includes	$285,465,000
"(a) the fixed price for capital assets as of August 3, 1954, of	$259,529,000
"(b) additional payments by purchasers for certain raw materials, work in process, spare parts and supplies, plus net additions to fixed assets as specified in contracts of sale which will amount to an estimated	$25,936,000
"(2) Contract sale price of miscellaneous equipment	$300,000
"(3) Inventories of synthetic rubber as of transfer date to be sold by FFC under Section 7k of Disposal Law which it is now estimated would produce at current market prices approximately	$24,800,000
"Total	$310,565,000
"Cost before depreciation (gross book value) of items (1) and (2) above as of transfer date will amount to an estimated	$488,584,000
and after depreciation (net book value)	$131,954,000
"FFC estimates it will have a cash balance for the synthetic rubber program on transfer date of approximately $91,000,000. This sum will be increased by cash proceeds of unsold net current assets (other than inventories of synthetic rubber) including component materials and diminished by expenses for unsold facilities, administrative and other costs.	
"It is estimated that the total of items (1), (2) and (3), plus cash on hand, will return to the Government over	$401,565,000."

do so, and there is no question of the technical competence of the purchasers, it was added.

As a final and additional safeguard, written into the several sales contracts is a clause insuring prompt availability of the facility or its equivalent for a period of 10 years from the date of the contract, which the Commission further modified to provide that the 10-year period shall commence at the time of transfer.

Competition

The Commission said that it believes the program recommended meets the standards set by the Congress, i.e., "the development within the United States of a free, competitive, synthetic rubber industry. . . ."

The problems of insuring competition differ, however, as far as the copolymer, butadiene, styrene, and Butyl rubber branches of the industry are concerned. First, sale of the styrene plant to Shell Chemical Corp. was considered to be to a corporation not now placed in a position of dominance in the styrene industry, and a corporation which will be an effective competitor for companies now producing styrene. Further, disposition of the styrene plant to Shell enables the Commission to dispose of the West Coast copolymer plant in a manner most likely to safeguard the competitive position of GR-S there.

With regard to the copolymer plants, the Commission pointed out that no one company has contracted to purchase more than 19% of the capacity recommended for sale. Small users have been safeguarded by placing a large segment of GR-S capacity in the hands of Shell Chemical and Phillips Chemical Co., neither of which is a rubber fabricator. In addition, in each contract for a copolymer plant the purchaser was required to make a commitment that he will make available to small business enterprises a certain specified amount of his production. (See Table 1.)

The butadiene plant disposals must enable butadiene producers to compete effectively with each other for the GR-S market and for the yet untapped markets which the Commission said will develop. This aim has been aided by the fact that the large butadiene plants are of such size and such efficiency as to be well adapted to compete with each other, and disposal of the large plant at Port Neches, Tex., to two separate companies in undivided halves is also consistent with the Commission's goal, it was pointed out.

The Commission received only two proposals for the two Butyl plants, both proposals from subsidiaries of Standard Oil Co. of New Jersey. Although the statutory requirement would have been satisfied by the sale of only one of these plants, the Commission said it felt both should be sold, one subject to resale in three years should interest develop. Both contracts contain provisions assuring a supply of Butyl rubber to small business enterprises.

Full Fair Value

The report said that no final definition of the requirements of the Disposal Act for "full fair value" was available, and this determination was left for the Commission, subject to review by Congress.

The Commission called attention to "the unrecovered investment of the American people" first placed before Congress by the Administrator of the Reconstruction Finance Corp. in the report of March 1, 1953. This figure presented the premise that the total program deficit plus the net book value resulted in the unrecovered investment in the synthetic rubber program. In the above-mentioned 1953 report this figure was given as $446,400,000, as of December 31, 1952.

Although the Commission did not adopt the unrecovered cost as a standard of full fair value, it did try to recover as much of the remaining investment as it possibly could. The December 31, 1952, figures, when projected to the possible transfer date of April 30, 1955, reflect a total unrecovered investment of $272,718,800, it was said. The total of the Commission's recommended sales (less current assets) is estimated to be, as of April 30, 1955, $263,643,000, or 96.6% of the unrecovered investment with no regard or credit for the unsold facilities and equipment which have a projected net book value as of April 30, 1955, of $18,557,000.

The Commission also referred to an appraisal of the facilities, except for the butadiene plants, made in 1952 for the RFC by Ralph M. Parsons Co., which, when projected to the April 30, 1955, date, amounts to $263,556,000, without including unsold facilities and equipment. The contracts of sale recommended by the Commission for the same facilities total an estimated $261,343,000, which is 99.2% of the estimated replacement cost less depreciation and obsolescence. The figure of $261,343,000 is composed of total fixed contract prices of $257,529,000 plus a conservative estimate of $3,814,000 for net capital additions and does not include current assets, it was added.

In a table which gave the results of operations of the synthetic rubber program since its inception in May, 1942, the Commission reported that the total deficit through June 30, 1954, was $194,805,803. This figure consists of loss after depreciation, shutdown, and reactivation expenses, operating cost adjustments, and non-operating losses, including losses from sale of plants through the June 30, 1954, date.

The Commission pointed out that in the course of the negotiations with the successful bidders for the plants recommended for sale sales prices were raised from the initial bid figures by more than $30 million. Also, during the course of the negotiations with bidders who did not become purchasers, the increase in this case over the initial bids amounted to more than $75 million. The Commission attributes its success in obtaining its final total figure to the willingness of both the successful and unsuccessful bidders to raise their bids and to the splendid cooperation of these bidders.

Without exception, the Commission sold to the highest bidder, but in the case of Shell Chemical Corp., a package sale of the styrene, butadiene, and copolymer facilities on the West Coast was made because this bidder declined to bid for the facilities individually. Shell's bid for the three facilities exceeded the total of the highest bids for each of the three individual facilities, however, it was said.

Patents

The Commission reported that all bidders were asked to indicate the patent and related rights the bidder intended to assert, and that additional information was made available by the Commission during negotiations. In the appendix of each contract of sale the Commission has agreed to assist purchasers to obtain the necessary patent rights, within the government's powers under previous agreements made with participants in the program.

The Commission also agreed to make available to purchasers the results of government-financed research in the synthetic rubber field.

Government Research

The Commission recommended that the industry and tire testing research programs being conducted by the Office of Synthetic

TABLE 1. JANUARY, 1955, DISPOSAL COMMISSION'S RECOMMENDATIONS FOR SALE OF GOVERNMENT SYNTHETIC RUBBER PLANTS

COPOLYMER (GR-S) PLANTS

Purchaser	*Location*	*Price*	*Terms*	*Gross Book Value 8-31-54*	*Net Book Value 8-31-54*	*Assigned Annual Capacity*	*Product Available to Small Business*
Copolymer Corporation	Baton Rouge, La. (Plancor 876)	$ 5,000,000	25% on closing date*	$ 9,268,331	$ 3,397,432	49,000 LT	10%
The Firestone Tire & Rubber Company	Akron, Ohio (Plancor 127)	$ 2,250,000	25% on closing date—balance in 10 equal annual installments	$ 7,452,230	$ 2,138,181	30,000 LT	20%
The Firestone Tire & Rubber Company	Lake Charles, La. (Plancor 1056)	$11,650,000	25% on closing date—balance in 10 equal annual installments	$16,427,973	$ 6,794,918	99,600 LT	20%
Goodrich-Gulf Chemicals, Inc.	Port Neches, Texas (Plancor 983)	$13,000,000	25% on closing date—balance in 10 equal annual installments	$22,049,192	$ 8,034,950	90,000 LT	Approximately 15,000 long tons per year
Goodyear Synthetic Rubber Corporation	Akron, Ohio (Plancor 126)	$ 2,075,000	25% on closing date—balance in 10 equal annual installments	$ 7,964,319	$ 3,076,797	15,200 LT	10%
Goodyear Synthetic Rubber Corporation	Houston, Texas (Plancor 956)	$11,889,000	25% on closing date—balance in 10 equal annual installments	$15,503,797	$ 5,982,370	99,600 LT	10%
American Synthetic Rubber Corporation	Louisville, Ky. (Plancor 1278)	$ 2,340,000	25% on closing date**	$ 8,982,730	$ 4,970,401	44,000 LT	4,000 to 15,000 long tons per year
Shell Chemical Corporation	Los Angeles, Calif. (Plancor 611)	Note A	25% on closing date—balance in 10 equal annual installments	$15,809,998	$ 7,238,195	89,000 LT	Percentage in line with proportion they represent of total market
Phillips Chemical Company	Borger, Texas (Plancor 982)	$ 4,525,000	Cash	$11,534,086	$ 4,637,707	63,000 LT	Major portion
United States Rubber Company	Naugatuck, Conn. (Plancor 129)	$ 3,200,000	35% on closing date—balance in 10 equal annual installments	$10,403,505	$ 3,328,285	22,200 LT	50% to 60% to small business enterprises and other users
Texas-U. S. Chemical Company	Port Neches, Texas (Plancor 983A)	$11,500,000	25% on closing date—balance in 10 equal annual installments	$14,778,074	$ 6,558,312	88,000 LT	20%

* 3% 1st year, 3% 2nd year, 7% 3rd year, 8% 4th year, 10% 5th year, 12% 6th year, 14% 7th year, 14% 8th year, 14% 9th year, 15% 10th year.
** 2% 1st year, 2% 2nd year, 2% 3rd year, 8% 4th year, 8% 5th year, 15% 6th year, 15% 7th year, 16% 8th year, 16% 9th year, 16% 10th year.

Note A: Price of $30,000,000 includes this plant as well as styrene plant (Plancor 929) and butadiene plant (Plancor 963) at Los Angeles and Torrance, California, respectively

BUTADIENE PLANTS—PETROLEUM

Purchaser	*Location*	*Price*	*Terms*	*Gross Book Value 8-31-54*	*Net Book Value 8-31-54*	*Assigned Annual Capacity*	*Disposition of Product*
Petroleum Chemicals, Inc.	Lake Charles, La. (Plancor 706)	$16,000,000	Cash	$18,702,207	$ 3,511,613	63,000 ST	To adjacent copolymer plant
Copolymer Corporation	Baton Rouge, La. (Plancor 152)	$ 5,000,000	25% on closing date*	$ 7,780,541	$ 1,108,308	23,000 ST	To adjacent copolymer plant
Humble Oil & Refining Company	Baytown, Texas (Plancor 485)	$ 8,886,000	Cash	$19,288,496	$ 3,248,449	46,000 ST	80% to copolymer plants at Louisville and Baton Rouge
Goodrich-Gulf Chemicals, Inc. Texas-U. S. Chemical Company	Port Neches, Texas (Plancor 933)	$53,000,000 Note A	25% on closing date—balance in 10 equal annual installments	$59,821,029	$10,320,325	190,000 ST	Approximately 43,000 short tons available on open market
Phillips Chemical Company	Borger, Texas (Plancor 484)	$19,100,000	Cash	$41,585,365	$ 5,919,405	74,000 ST	To adjacent copolymer plant
Food Machinery and Chemical Corporation	Houston, Texas (Plancor 1063)	$24,197,000	25% on closing date—balance in 10 equal annual installments	$31,879,360	$ 6,607,873	90,000 ST	To adjacent copolymer plant
Shell Chemical Corporation	Torrance, Calif. (Plancor 963)	Note B	25% on closing date—balance in 10 equal annual installments	$20,672,471	$ 3,268,073	48,000 ST	To adjacent copolymer plant
Standard Oil Company of California	El Segundo, Calif. (Plancor 1593)	$ 1,500,000	Cash	$ 7,832,371	$ 715,488	50,000 ST**	Butadiene to copolymer plants or butadiene - butylene mixture to butadiene plants

* 3% 1st year
3% 2nd year
7% 3rd year
8% 4th year
10% 5th year
12% 6th year
14% 7th year
14% 8th year
14% 9th year
15% 10th year

Note A: Each purchaser is to pay 50% of this amount for undivided half interest.
Note B: Price of $30,000,000 includes this plant as well as styrene plant (Plancor 929) and copolymer plant (Plancor 611), Los Angeles, California.

** Equivalent butadiene (crude butadiene and normal butylenes)

TABLE 1 (CONTINUED)

STYRENE PLANT

Purchaser	Plant Location	Price	Terms	Gross Book Value 8-31-54	Net Book Value 8-31-54	Assigned Annual Capacity
Shell Chemical Corporation	Los Angeles, Calif. (Plancor 929)	Note A	25% on closing date—balance in 10 equal annual installments.	$15,154,071	$3,315,119	62,500 ST

Note A: Price of $30,000,000 includes this plant as well as butadiene plant (Plancor 963) and copolymer plant (Plancor 611) Torrance, Calif. and Los Angeles, respectively.

BUTADIENE PLANT—ALCOHOL

Purchaser	Plant Location	Price	Terms	Gross Book Value 8-31-54	Net Book Value 8-31-54	Assigned Annual Capacity
Koppers Company, Inc.	Kobuta, Pa. (Plancor 483)	$2,000,000	Cash	$45,584,297	$10,466,580	80,000 ST

DODECYL MERCAPTAN PLANT

Purchaser	Plant Location	Price	Terms	Gross Book Value 8-31-54	Net Book Value 8-31-54	Assigned Annual Capacity
United States Rubber Company	Naugatuck, Conn. (Plancor 543)	$60,000	Cash	$383,304	$135,860	2,400 ST

MISCELLANEOUS FACILITIES

Purchaser	Location of Facilities	Price	Terms	Gross Book Value 8-31-54	Net Book Value 8-31-54
Great Southern Chemical Corporation	Corpus Christi, Texas	$300,000	2% First Year—Balance over succeeding 9 years in equal quarterly installments	$1,295,194	$932,131

Rubber should be discontinued upon transfer of the plants.

The programs being conducted through universities and institutes and the government laboratory operated by the University of Akron should be continued substantially as they are through fiscal 1956.

The continuing program should be placed in the hands of the National Science Foundation for supervision and control.

When and if the basic research program is placed in the hands of the National Science Foundation, it was suggested that three of the eleven members of the special commission required by law for the Foundation be nominated by the Department of Defense because of the substantial interest of that department in the program of basic research on synthetic rubber.

Mention was made of the desire of the University of Akron either to continue to operate the government laboratory under lease or acquire it and operate it as its own. The Commission said such a transfer might be desirable, but suggested that the final decision be deferred until more experience is gained with its operation by those better able to determine its value.

FFC Assures Uninterrupted Flow of Purchase Orders

Federal Facilities Corp. on January 25 announced its plans "to supply all foreseeable demands for GR-S and Butyl without any interruption before or after the transfer" of the government-owned synthetic rubber plants to private industry.

Contemplated transfer date is April 30, although it may come a few days earlier.

FFC said all plants will be turned over to private owners "on a full production basis" at the transfer date. All plant buyers have agreed to buy from the agency all inventories of finished rubber left in government hands. These inventories—about 45,000 tons of GR-S and 8,000 to 10,000 tons of Butyl—"will be sufficient to permit an uninterrupted flow of rubber from plants to consuming fabricators.

"FFC will accept and deliver against purchase orders for GR-S and GR-I up to and including the month of April. This obligation will continue uninterrupted in the event there is a delay in the disposal program," the agency said.

FFC gave these instructions for future purchases:

Small consumers—those now ordering GR-S on a 30-day delivery basis—and all GR-I consumers are to place purchase orders with private producers beginning in May.

Large consumers—those ordering on a 90-day basis—should continue this practice through delivery months May through July, besides placing duplicate orders with plant purchasers for the same delivery months. If the plants go over to private hands on April 30, the May-July orders with FFC will be cancelled automatically.

FFC will inform each consumer, large and small, which of the plant purchasers has bought government inventory of the type or types of rubber the particular consumer uses.

Rubber Items in President's Budget

Congress received two major documents containing some "vital statistics" on the synthetic rubber business in January. One was the above-mentioned long-awaited report of the Rubber Producing Facilities Disposal Commission with its announcement of how much money it had been offered for the government rubber plants. The other, preceding the Commission's report by 10 days, was the bulky Eisenhower budget for the coming fiscal year, starting July 1.

The budget report (1,224 pages of eye-straining agate type) disappointed those who hoped to find among its myriad tables and balance sheets some advance inkling of what the rubber plants might sell for. The only figure used as a measure of the value of the plants was their depreciated book value as of June 30, 1955. That figure was $112,032,400. However, it's strictly a bookkeeping figure—not a measure of actual value. Last year's budget report carried the figure more nearly related to value—a $540-million total representing original cost plus capital improvements projected to the same date, June 30, 1955. This figure was not repeated in the fiscal 1956 budget.

Nevertheless the new budget contained a good deal of balance sheet "dope" on how the rubber program is faring in the 12-month period which comes to a close on June 30. Gross income of the program was estimated at $278.5 million, and total expenses at $242,140,000. That will leave a net profit of $36,360,000—reduced to an even $36 million after deducting for expenses of the Disposal Commission.

That $36 million works out to a net profit of about 13¢ on each dollar of sales —about the same ratio as that obtained for the previous three years.

The government figures on doing some rubber business in the coming fiscal year—even if it's no longer producing rubber. It will still have some rubber on hand—$36.9 million worth—to sell to private industry. It will also have $4 million in mortgages receivable.

But the balance sheet for a year which started with a sharp drop in sales of synthetic rubber, picking up only recently toward new monthly peaks, is worth some study. Here's a breakdown by major headings of the rubber program's financial showing as estimated for the 12-month period which ends June 30, 1955:

Income: Sales:		
Synthetic rubber and inventories of raw materials	$263,500,000	
Freight charges to customers	15,000,000	
Total Income		$278,500,000
Expenses:		
Cost of goods sold:		
Purchase and processing costs	$161,439,770	
Decrease in inventory	26,160,230	
Cost of goods sold	$187,600,000	
Administrative expense	1,681,800	
Depreciation on administrative facilities	12,200	
Freight	15,000,000	
Research and development	4,200,000	
Shutdown expense including protection and maintenance	1,700,000	
Other	5,446,000	
Depreciation	23,000,000	
Allowance for self-insurance	2,000,000	
Interest on funds invested in net operating assets	1,500,000	
Total Expenses	$242,140,000	
Total Income from synthetic rubber program	36,360,000	
Less expenses of Rubber Disposal Commission	360,000	
Net Income from synthetic rubber program	$36,000,000	

The President said that for the coming year—fiscal 1956—"the synthetic rubber budget program provides for disposal to private interests of such inventories of finished rubber ($36.9 million) as may not be included with the sale of the rubber producing facilities. The budget also provides for the protection and standby maintenance ($1 million) of such rubber producing facilities as may not be included in the disposal program approved by the Congress. Provision ($4.2 million) is also made for continuation of the government's synthetic rubber research program in fiscal year 1956, pending submission to the Congress of the President's recommendations as to continuation of such research."

Total expenses were put at $40,281,200 —resulting in a net loss for the coming year of $3,381,200. These expenses cover several smaller items as well, including $700,000 in administrative expenses for the "wind-up of the synthetic rubber program."

BDSA Suggests Rubber Shortage

Assuming Congress approves the disposal program as presented by the Rubber Disposal Commission—will the rubber industry, not to mention its customers, have enough synthetic rubber capacity for "economic safety"?

That question, prominent in the thoughts of rubber users large and small, was taken up last month in the "Chemical and Rubber Report," the second of a new monthly series, issued by the Business & Defense Services Administration (BDSA) of the Department of Commerce.

With military safety—rather than economic safety—uppermost in mind, Congress laid down as a major condition for disposal that sufficient capacity be sold to produce a minimum of 500,000 long tons of GR-S and 43,000 tons of Butyl rubber annually. The disposal law left the door open to the sale of even greater capacities, all the way up to the limit of the government facilities—roughly 860,000 tons of GR-S and 90,000 tons of Butyl.

Proposed Plant Sales Adequate

The Commission has signed contracts covering a total capacity somewhere between the maximum and the minimum. The capacity covered by its contracts is 689,600 tons for GR-S and 90,000 tons for Butyl. The condition for national security, as specified by Congress, clearly is more than met by this performance.

If Congress takes this disposal package —without knocking out any of the proposed contracts or, on the other hand, requiring a forced sale of the few plants which at present are destined for "mothballing"—we will probably have a large enough synthetic rubber industry in private hands to provide a margin for economic safety.

If some sales are rejected, there may not be enough synthetic capacity to handle the load in times of heavy demand. Such shortages would almost certainly leave this country's consuming industry without means of halting an upward spiral in natural rubber prices. They might, too, bring higher prices for synthetic.

Indonesian Smallholders' Importance

"When a tight rubber market develops," BDSA said, "there are two chief sources from which relief may come in the form of increased production. One is higher output of GR-S in the United States; the other is higher exports of rubber produced by smallholders in Indonesia. In the absence of increased use and production of GR-S, the cure for the supply problem depends primarily on Indonesian smallholder rubber. . . . it is to Indonesian smallholders that one must look for substantially increased supplies, since on the basis of past performance latent capacity does exist there."

Increased supplies from that source are now on their way, the report continues, pointing to official estimates showing exports of Indonesian rubber exceeding previous forecasts in the latter part of 1954.

"Whereas advance estimates for 1954 natural rubber production foresaw a world total of 1,700,000 to 1,725,000, the nine-month total adjusted for normal seasonal variation now points toward an output of 1,760,000 tons.

"During the next two or three years, world natural rubber production could be less than 1,700,000, or more than 1,850,000 tons in any year, depending on the output of Indonesian smallholders. What it will be in any particular year will depend on the price and trend of price for natural rubber during that year. Since the price of natural rubber at present is much higher than at the start of 1954, it is to be expected that Indonesian smallholder production will be higher during the fisrt half of 1955 than it was in 1954. . . . "

GR-S Production Increase Lag

But there's a time lag in the response of such smallholder production to price stimulus. The same holds true for increasing the supply of GR-S, BDSA points out.

"Whether the time lag for increasing GR-S production would be similar under private ownership to the experience under government one-package operation is uncertain. There is little reason to expect that the lag would be any less, and the limit of expansion would be the capacity of the plants disposed of, which is expected to be less than total present capacity.

"If it were assumed that the disposal of facilities would result in a sale of only the capacity stated in the Disposal Act as the minimum for disposal, it is quite clear that the tonnage would not be adequate for the economic safety of the consuming industry. Against the capacity minimums of 500,000 long tons of GR-S and 43,000 long tons of Butyl, the average U. S. consumption of GR-S and Butyl in 1950-53 was 566,500 tons and 68,700 tons, respectively, not including imported synthetics [a nominal figure—AJK]. As recently as the first half of 1953, consumption of GR-S in six months was 347,000 tons; so allowance needs to be made for the traditional wide variations in U. S. consumption in considering the capacity desirable for our economic safety."

While BDSA does not come up with a specific figure for assuring "economic safety," it would seem clear from its

analysis that the consuming industry can poorly afford to have anything less than the tonnages already under contract with the Disposal Commission transferred to private ownership.

FFC and Production Figures

Government sales of GR-S will hit a new monthly peak in March, but the new record won't last very long.

Federal Facilities Corp., in its regular monthly forecast of production and sales, said it expects to sell 66,000 long tons of GR-S in March—topping the previous all-time monthly high of 61,400 tons recorded in March, 1953.

But the new record will be topped in April, if FFC's forecast for that month pans out. The agency said that advance orders submitted in January point to an April sales total of 69,000 tons.

February sales were estimated at 58,000 tons—8,000 tons more than previously predicted for that month. The March sales estimate also was revised upward over the previous FFC forecast of a 62,000-ton total.

FFC Administrator Laurence B. Robbins attributed the sales gain to increased overall demand for new rubber and increased prices for natural rubber. He offered no opinion as to how much of the boost in GR-S demand should be attributed to its price advantage over natural rubber.

The agency, he said, is running all of its plants at "full capacity" to meet the big demand for tire and other consumer factories. Production will be boosted to 54,000 tons in February and 61,000 tons in March—up 5,000 tons from previous estimates for each of those months.

Government-held inventories amounted to about 57,000 tons on December 31, 1954, FFC reported.

National News

Natural Rubber Bureau 1955 New Rubber Supply-Demand Estimates; Sees First Really Competitive Market This Year

In its January *Natural Rubber News* and in a supplementary release, the Natural Rubber Bureau, which represents the rubber growers of Malaya in the United States, announced its estimate of production and consumption of natural and synthetic rubber for 1954 and made a forecast for 1955.

H. C. Bugbee, NRB president, indicated that he felt the year 1955 would see the first competition of natural rubber with privately produced, competively priced synthetic rubber, assuming the sale of the U. S. Government synthetic rubber plants to private industry in accordance with the recommendations of the Rubber Facilities Disposal Commission.

"Under the spur of free enterprise, we expect that synthetic rubber producers will better their product," Bugbee said. "We know that natural will. Even now, rubber geneticists are working at improving the output of trees that already produce four times more rubber than did the trees two decades back," he added.

NRB pointed out that in its estimates for 1954, a 45,000-long ton excess of supply over consumption demand is shown. This excess is offset by a deficit of 20,000 tons of synthetic rubber (from stocks), creating a net world excess of only 25,000 tons.

Bugbee described this close supply situation as "one of the basic reasons for today's rising price of natural rubber."

The 1955 figures estimate only a 20,000-ton natural rubber margin of world supply over world demand, and a balanced position for synthetic rubber; a statistical position similar to that for 1954, i.e., a rubber excess so slight it could be quickly eliminated by a decrease in production, stepped up consumption, or combination of both. Increased production and usage of synthetic rubber would, of course, widen the apparent close balance between supply and demand of all new rubber.

Speaking for the producers of natural rubber, Bugbee decried the sharp market fluctuations in the price of natural rubber that have occurred during the past few months and during the period before, during, and after the Korean War.

"The Malayan producer does not want a feast or famine type of market. He wants a stable market built about competition with privately owned, competitively priced synthetic rubber. Under such circumstances, the natural rubber producer would be able to better plan for the future, a rubber future in which we are convinced there is sufficient market for the full utilization of both synthetic and natural rubber production at a profitable and stable level."

Bugbee voiced the belief of many experts in the rubber field that projected population and usage figures indicate world consumption between 3,300,000 and 3,700,000 tons annually by 1960.

Using the natural and synthetic rubber preference figures in the general-purpose field given by J. N. Street, Firestone Tire & Rubber Co., in his talk before The Rubber Manufacturers Association in New York, on November 18,[1] and applying these percentages to the estimated market for 1955, NRB estimated that natural rubber's share of the projected 1,005,000-ton U. S. market for general-purpose dry rubber will be approximately 535,000 tons to synthetic rubber's 470,000 tons.

TABLE 2. NRB RUBBER PRODUCTION AND CONSUMPTION ESTIMATES

	Natural	Synthetic*	Total
1954 Production Estimated			
U. S. A.		618,000	618,000
Malaya	595,000		595,000
Indonesia	715,000		715,000
Rest World	450,000	92,000	542,000
	1,760,000	710,000	2,470,000
Consumption Estimated			
U. S. A.	600,000	630,000	1,230,000
United Kingdom	220,000	8,000	228,000
U. S. S. R., Satellites, China	120,000		120,000
Rest World	775,000	92,000	867,000
	1,715,000	730,000	2,445,000
1955 Production Estimated			
U. S. A.		660,000	660,000
Malaya	600,000		600,000
Indonesia	740,000		740,000
Rest World	460,000	100,000	560,000
	1,800,000	760,000	2,560,000
Consumption Estimated			
U. S. A.	610,000	650,000	1,260,000
United Kingdom	230,000	10,000	240,000
U. S. S. R., Satellites, China	140,000		140,000
Rest World	800,000	100,000	900,000
	1,780,000	760,000	2,540,000

* No synthetic production or consumption figures included for U.S.S.R., satellites, and China (internal production of synthetic probably closely offset by internal consumption of synthetic).

Collyer Suggests Natural Stockpile Reduction

In a letter to Arthur S. Flemming, director, Office of Defense Mobilization, in early January, John L. Collyer, chairman of the board, The B. F. Goodrich Co., proposed that government expenditures be reduced by ending further additions to the national stockpile of natural rubber and at the same time disposing of natural rubber which might be in excess of the tonnage required for a national emergency.

Collyer pointed out that calculations made from published, non-classified figures indicate that the U. S. Government owns, within our borders, more than 1,200,000 tons of natural rubber having an estimated cost of $825,000,000. If so, the government stockpile, plus private stocks in the United States, now totals more than 1,300,000 long tons, he added.

This stockpile of natural rubber coupled with capacities for the production of synthetic rubber in the United States

[1] See our Dec., 1954, issue, p. 387.

would take care of our military and civilian needs during an all-out war of six to possibly eight years' duration, assuming that the rubber stocks would not be destroyed, or the synthetic rubber plants cripped by enemy, or other action, according to the Goodrich executive.

Policy Review Urged

He added further that he believes that the government should answer two important questions regarding our stockpiling policies.

1. What is the proper stockpile level in the light of current military knowledge and planning, and considering the advancing state of rubber technology? In this connection, it is our understanding that today the Armed Forces of the United States are adequately equipped with most types of finished rubber products, that pipelines are full, and that additional quantities of some finished products are being stored against future needs.

2. How can the present stocks be reduced to a lower level in line with real national defense needs without violating the letter and spirit of the international commitments of our State Department relating to government management of the crude rubber stockpile?

Discussing natural rubber requirements in the event of a major war, Collyer said that in 1948 a special committee from the rubber manufacturing industry made a study for the government of possible natural rubber requirements in the event of a major war. At that time it appeared that if we were to accumulate government and private natural rubber stocks of 800,000 long tons, the amount would be adequate for "any foreseeable situation" except destruction of the rubber stocks or of the facilities for producing synthetic rubbers.

Washington Reaction

Officials in Washington in commenting on the Collyer proposal said that no additions have been made to the natural rubber stockpile in more than a year, and that it was reported not long ago that the stockpile objective had been met. The only natural rubber being bought by the government is for stockpile rotation.

It was admitted that opinions may vary on how large the stockpile should be, and that no one in industry has access to the assumptions on which stockpile determinations are based. The rubber stockpile objective is under complete review at the present time and should be completed within a few months.

It was added that there are no "international commitments," only Public Law 520, passed in 1946, which requires a six-month notice on any plan to reduce the stockpile and to dispose of stockpiled materials. Any plan must protect this country against "avoidable loss" and protect "producers, processors, and consumers against avoidable disruption of their usual markets."

There was speculation that Collyer's letter was intended to indicate the rubber goods manufacturers' dissatisfaction with the present high price of natural rubber. According to the Natural Rubber Bureau, as reported elsewhere in this issue, the high natural rubber price results from a minimum available world excess of new rubber, and any reduction in our natural rubber stockpile would increase the available new rubber with a quite probable lowering of the price of natural.

Tire Prices Increased Again

For the second time in a little over two months, a tire price increase was made by the industry in early January.

United States Rubber Co. announced, January 7, an increase of from 2½% to 5% in the price of its passenger-car, truck, and farm tires and tubes. The increase is a direct result of increased costs, particularly the very substantial increase in the prices of natural rubber, according to the company.

Shortly thereafter, Goodyear Tire & Rubber Co. and The B. F. Goodrich Co. announced similar increases, which will undoubtedly be followed by those of other tire manufacturers.

CALENDAR of COMING EVENTS

February 15
Elastomer & Plastics Group, Northeastern Section, A. C. S.

February 16
Washington Rubber Group, Potomac Electric Power Co. Bldg., Washington, D. C

February 18
Chicago Rubber Group, Inc. Furniture Club, Chicago, Ill.

March 1
The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.

March 10
Northern California Rubber Group.

Elastomer & Plastics Group, Northeastern Section, A. C. S.

March 16
Washington Rubber Group, Potomac Electric Power Co. Bldg., Washington, D. C.

March 17-19
Division of High-Polymer Physics, American Physical Society, Baltimore, Md.

March 18
Chicago Rubber Group, Inc. Furniture Club, Chicago, Ill.

March 25
Boston Rubber Group, Somerset Hotel Boston, Mass.

April 1
Akron Rubber Group, Spring Meeting, Mayflower Hotel, Akron, O.

New York Rubber Group, Henry Hudson Hotel, New York, N. Y.

April 5
The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.

April 6-10
World Plastic Fair & Trade Exposition, National Guard Armory, Exposition Park, Los Angeles, Calif.

April 14
Northern California Rubber Group.

Fort Wayne Rubber & Plastics Group.

April 18-21
A.M.A. National Packaging Exposition, International Amphitheatre, Chicago, Ill.

April 20
Washington Rubber Group, Potomac Electric Power Co. Bldg., Washington, D. C.

April 29
Chicago Rubber Group, Inc. Furniture Club, Chicago, Ill.

May 3
The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.

May 3-6
Second International Rubber Quality & Packaging Conference, Essex House, New York, N. Y.

May 4-6
Division of Rubber Chemistry, American Chemical Society, Sheraton Cadillac Hotel, Detroit, Mich.

May 12
Northern California Rubber Group.

May 16-21
Materials Handling Exposition, International Amphitheatre, Chicago, Ill.

May 17
Elastomer & Plastics Group, Northeastern Section, A. C. S.

May 18
Washington Rubber Group, Potomac Electric Power Co. Bldg., Washington, D. C.

June 10
Fort Wayne Rubber & Plastics Group, Summer Outing.

June 24
Detroit Rubber & Plastics Group, Inc. Summer Outing.

Other Industry News

Second French Rubber Mission Itinerary

The second French rubber industry technical mission, whose arrival was mentioned in our January issue,[1] is composed of nine technical and management personnel. The mission's visit is sponsored by the Foreign Operations Administration and has as its purpose providing the French rubber industry with a knowledge of up-to-date techniques in certain phases of rubber manufacture where French technical development is retarded or incomplete; and helping the industry to improve management methods with special reference to production and budgetary control, cost accounting, and the organization of research.

Items of technical nature of special interest to the mission are in the fields of compounding and processing for such mechanical rubber goods items as rubber hose and belting, coated fabrics, and cellular rubber.

Upon its return to France the team will prepare a comprehensive report, and meetings and conferences will be held for the purpose of making recommendations toward increased efficiency and the adoption of these recommendations by the French rubber industry.

While in this country the mission will have as its project leader Edward Gilman, Jr., FOA, International Technical Developments Branch. Upon its arrival in this country on January 11, the mission was entertained for lunch in New York, N. Y., by United Carbon Co., and the accompanying photograph shows the members of the mission and other guests with their luncheon hosts.

On January 12 the mission met with W. J. Sears and J. J. Catterall, of The Rubber Manufacturers Association, Inc., in New York.

The week of January 17 was spent in the New England area with visits to Farrel-Birmingham Co. in Ansonia, Conn.; Stowe & Woodward, Inc., Needham, Mass.; Avon Sole Co., Avon, Mass.; and Hodgman Rubber Co., Framingham, Mass.

The mission spent January 22 at the Dunlop Tire & Rubber Co., Buffalo, N. Y., and then these visitors journeyed on to Akron, O.

January 24 was spent at the Xylos Rubber Co., in Akron, and January 25 at the Firestone International Co. Faultless Rubber Co., Ashland, Ohio, was visited on January 26, and the mission then traveled to the Dryden Rubber Division of Sheller Mfg. Co., Chicago, Ill.

The B. F. Goodrich Chemical Co. plant in Avon Lake, O., and the B. F. Goodrich Co. Research Center, Brecksville, O., were visted on the twenty-eighth of January.

Returning to Akron on January 31, the team made visits to McNeil Machine & Engineering Co. and the United Rubber Workers of America, CIO. February 1 was spent at the E. I. du Pont de Nemours & Co. rubber laboratory in Akron and with the International Chemical Workers Union of the American Federation of Labor.

In Akron on February 2, the mission spent that day with the Goodyear Tire & Rubber Export Co. February 3 was spent with Rempel Mfg. Co. and Akron Standard Mold Co., both in Akron.

The Wooster Rubber Co., Wooster, O., was visited on February 4; then the mission moved on to Washington, D. C., from which it journeyed to Belks Corp., Franklinville, Md., on February 7.

February 9 and 10 were spent in Washington with the American Council on Education, the United States Department of Labor, and in an evaluation meeting with FOA officials. February 11 was occupied by a visit to the Quaker Rubber Corp., Philadelphia, Pa.

Then the mission returned to New York in order to embark for France on February 15.

[1] P. 527.

Second French Rubber Industry Technical Mission and other guests after luncheon with United Carbon Co. representatives in New York, January 11, 1955. Standing, left to right: S. Raistrick, British Anchor Chemical Co.; M. E. Lerner, "Rubber Age", **Jean Labarraque,** Etab. Cleret-Pontin; **Antoine Gianni,** Etab. R. Pincet & J. Baratte; H. S. MacLean, Imperial Chemical Industries; **François Roullet-Chery,** Etab. Hutchinson; Edward Gilman, Jr., FOA; **Paul Lachaud,** Manufacture Lyonnaise du Caoutchouc; **Paul Rothenburger,** Société a Responsabilitie Limitee Calec; Michel Curtis, interpreter; and R. G. Seaman, RUBBER WORLD. Seated, left to right: J. B. Barr, United Carbon Co.; **Michel Rideau,** Hutchinson-Langlée; **Jean Duttlinger,** Société A. Wolber; I. Drogin, United Carbon Co.; **René Aubertin,** Le Caoutchouc S. I. T.; and **Edmond Barrié,** Cie. de Caoutchouc Manufacture Dynamic.

(Names in bold face identify members of the mission)

F-B Reshuffles Own Machine Tool Subsidiary

Consolidated Machine Tool Corp., wholly owned subsidiary of Farrel-Birmingham Co., Inc., Ansonia, Conn., has been dissolved as a separate corporation, and its business and production activities will now be conducted as a division of the parent corporation. The new division will be known as Consolidated Machine Tool Co. and will continue its production of machine tools in Rochester, N. Y.

According to Franklin Hoadley, president of Farrel-Birmingham, and Lester D. Chirgwin, president of Consolidated, the move was made for the purpose of simplifying the administration of both organizations and will entail no physical changes other than minor ones in the accounting and billing departments.

Farrel-Birmingham has plants in Ansonia and Derby, Conn., and in Buffalo, N. Y. The subsidiary was acquired in 1951 by the purchase of its common stock from its owner, the late Arthur H. Ingle.

To Make Foam Rubber Fabrics

Collins & Aikman Corp., Roxboro, N. C., manufacturer of furniture and automobile upholstery, has announced its entry into the field of foam-rubber backed fabrics, materials now widely demanded in the shoe, cosmetic, and other industries. The firm will manufacture and distribute these fabrics under its Candalon trade mark, using the process developed by Andrews Alderfer Co., Akron, O., manufacturer of Fabricushion.

According to the company, the process entails the direct application to the fabric of the foam rubber in liquid form, eliminating the use of adhesive or bonding material. The first rubber-backed carpet made by this method for the automobile indutry was introduced by Collins & Aikman two years ago and is now used in all makes of cars because of its long-wearing qualities, the company says.

Air-Borne Customer Service

Four top executives and an engineer of Lord Mfg. Co., Erie, Pa., have taken to the air to speed up customer service. The company maintains a four-seat Beechcraft Bonanza at Erie Municipal Airport, located within minutes of its offices.

All pilots, the executives are Thomas Lord, president; George E. Tubb, vice president in charge of sales; Charles L. Freel, manager of field engineering; and Richard C. Henshaw, manager of engineering. Phil H. Woodford, product and sales engineer, is the firm's fifth pilot.

Lord, manufacturer of bonded rubber products, also maintains a four-seat Ryan Navion at its Dallas, Tex., office for similar operations. Accurate records are being kept of the cost of operating the two planes to determine the long-range practicability of the scheme.

Goodrich to Aid German Firm

The B. F. Goodrich Co. has entered into an agreement, approved by the West German Government, to provide technical assistance to Veith-Gummiwerke of Germany, it has been announced by W. C. Gulick, president of International B. F. Goodrich, Akron, O.

The German firm, one of the largest rubber companies in Germany, produces tires and tubes and various industrial rubber products. Also, the industrial group of which it is a member is active in the textiles, machine tool, and tannery industries. Following World War II, Veith-Gummiwerke resumed production in its principal plant at Hochst, near Frankfurt-a.M., in 1945, with the assistance of the United States Military Government.

Now employing more than 2,000, the company has branch offices in the principal cities of the West German Republic and is engaged in export activities. Its expansion program includes the production of tubeless tires, as well as other rubber and plastics products.

International B. F. Goodrich presently furnishes technical assistance to nine foreign associated companies.

Develops New Retread Method

A new method for applying treads to worn truck tires has been announced by The Firestone Tire & Rubber Co., Akron, O. The technique is based on careful measurement of the used tire so that exact patterns can be set up for buffing the tire and for applying the proper-size stock for curing.

Used tires vary in size because of differences in manufacturing methods and the variations in wear to which they are subjected, Firestone says. Inaccurate measurements often result in a distorted retread, causing imperfect curing, thin spots, and buckled tire bodies.

Known as Firestone Dimension Contour Method, the technique is now being used by all the company's retread shops.

Price of Two Neoprenes Cut

A 5% reduction in the price of Neoprene Types W and WHV has been announced by the rubber chemicals division of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Dropped from 41 to 39¢ a pound, Types W and WHV now constitute one-third of the company's dry neoprene sales volume.

The price cut was made possible, du Pont says, by manufacturing economies resulting from process improvements and the 2½-fold increase in production of these types which has occurred in the past year.

Types W and WHV have proved more economical to use for most purposes than other neoprenes, du Pont adds.

Washington Road Rubberized

A section of MacArthur Boulevard in Washington, D. C., has been repaved with an asphalt-rubber mixture using Synthetic Latex Compound R-504, a product of The Fireston Tire & Rubber Co., Akron, O. The test strip will now be subjected to long-range critical analysis by the Bureau of Standards and Bureau of Public Roads.

According to Firestone, the latex was added to the mixture after the aggregate had been asphalt-coated, with accepted mixing methods calling for the addition of latex in the amount of 10% by weight of the asphaltic oil. The latex is approximately 50% water, giving the added advantage of steam dispersion of rubber particles as the water is flashed off by the heated aggregate during the remainder of the normal mixing cycle, Firestone adds.

During 1954, Compound R504 was used in repaving highway strips in Kansas, Nebraska, Kentucky, Wisconsin, Ohio, Utah, Rhode Island, and the District of Columbia.

HumKo To Sell Own Hystrene

The marketing of Hystrene fatty acids has been transferred from Atlas Powder Co., Wilmington, Del., to HumKo Co., Memphis, Tenn., it has been announced. Atlas for the past five years has been sole sales agent for the Hystrene line, manufactured by HumKo's Trendex division. The move was said to have been mutually agreed upon, with HumKo giving credit to Atlas's specialized marketing techniques for the trade acceptance of Hystrene.

HumKo, however, will continue its close relations with the Wilmington firm; agreements have already been concluded whereby HumKo will supply raw materials to an Atlas emulsifier plant being completed adjacent to its own Memphis plant.

De-Icers for Helicopters

Electrically heated rubber "boots" to warm the rotor blades of helicopters and prevent the formation of hazardous ice have been developed by The B. F. Goodrich Co., Akron, O. Resembling heating pads in operation, the boots have small resistance wires embedded in the rubber and connected to the plane's electrical supply. They encase nearly the entire length of the blades.

Now installed on Bell helicopters, the anti-icers enable the ships to operate in weather and regions they never could before, Goodrich reports. The heating pads can be made in any shape or size to fit such parts as antenna masts, propellers, air scoops, spinner domes, and cowl rings, the company says.

Goodrich manufactured all de-icers used on U.S. bombing aircraft during World War II.

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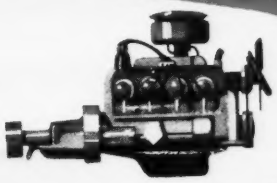

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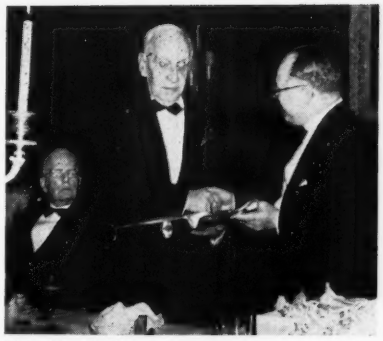
Viles Feted by Rubber Industry Leaders

A. L. Viles, who retired as president of The Rubber Manufacturers Association, Inc., on January 1, was feted at a party in his honor at the Racquet & Tennis Club in New York, N. Y., January 18.

Leading executives of the rubber industry and executives of the Association present at this affair were Frank Baldwin, assistant to the chairman, and P. W. Litchfield, chairman of the board, Goodyear Tire & Rubber Co.; John L. Collyer, chairman of the board, The B. F. Goodrich Co.; H. E. Humphries, Jr., president, and H. G. Smith, executive vice president, United States Rubber Co.; H. S. Firestone, Jr., chairman of the board, and L. R. Jackson, president, Firestone Tire & Rubber Co.; William O'Neil, president, The General Tire & Rubber Co.; E. A. Callanan, president, Brown Rubber Co.; Hugh Bullock, president, Tyer Rubber Co.; A. A. Garthwaite, president, Lee Rubber & Tire Corp.; H. E. Smith, retired vice president, Raybestos-Manhattan, Inc.; G. B. Dryden, retired president, and E. G. Vinnedge, vice president and general manager, Dryden Rubber Division, Sheller Mfg. Corp.; A. L. Freedlander, president, Dayton Rubber Co.; J. P. Seiberling, president, Seiberling Rubber Co.; and R. R. Ormsby, president, W. J. Sears, vice president, George Flint, secretary, C. C. Halligan, treasurer, of the RMA.

The accompanying photograph shows Mr. Seiberling, who acted as toastmaster of the affair, presenting a memento of the occasion in the form of a sterling silver tray to Mr. Viles. The inscription on the tray read, "Presented to Albert L. Viles by the board of directors of The Rubber Manufacturers Association, Inc., and the rubber manufacturing industry on his retirement as president of The Rubber Manufacturers Association, December 31, 1954, in recognition and appreciation of his outstanding leadership for more than 36 years in the advancement of cooperative effort essential to the expansion and development of the rubber manufacturing industry."



Blackstone Studios

Mr. Seiberling presenting inscribed sterling silver tray to Mr. Viles at the Racquet & Tennis Club, New York, January 18; Mr. Dryden in background

Linde Hiring for W. Va., Silicon Rubber Plant

About 170 residents of the Long Reach, W. Va., area will be hired before the end of 1955 for work at the new silicones plant being erected there by Linde Air Products Co., division of Union Carbide & Carbon Corp., New York, N. Y., the company reports. The number will be increased to about 325 by the time the plant reaches full-scale production.

Employes hired will be for clerical work, power facilities operation, chemical operation, maintenance, security, and other services. Between 28 and 34 Linde employes with specialized skills will be transferred there from other plants. Long Reach, an underdeveloped locality, is expected to benefit economically from the new installation.

According to Linde, external construction work on office and other non-process buildings is almost completed. Boilers are now being built, as well as reactor and rectification towers, tank farms, and other process equipment.

Armstrong Company Gives Life-of-Tire Guarantees

An unconditional lifetime guarantee for all of its passenger tires is being offered by Armstrong Rubber Co., West Haven, Conn. The guarantee covers stone bruises, blowouts, rim cuts, and all other road hazards, and the company will replace any tire thus injured with a tire of the same size and type on a pro rata basis; the customer will receive credit for the unexpired normal life of the tire, as determined by the depth of the remaining tread. This guarantee replaces those previously offered on certain tire types, which ranged from 18 to 36 months.

Goodyear Tubeless for U. S. Navy

The U. S. Navy has awarded contracts to the Goodyear Tire & Rubber Co., Akron, O., for delivery of tubeless tires for two of its newest jet fighter aircraft, the Grumman F9F-9 Tiger and North American's FJ-4 Fury, according to E. M. Eickmann, manager of the company's aviation products. The planes will be the first equipped entirely with tubeless tires.

The tires were adopted after extensive tests in both actual carrier operations and simulated carrier arrested landings at the Patuxent River Naval Air Station. The Navy has also beten partially employing the Goodyear tubeless on its Chance-Vought F7U-3M.

The advantages of the tubeless in Naval air operations, according to Goodyear, include weight saving, facility of mounting, easier maintenance, cooler operation, and more simplified supply problems. The tire is constructed with nylon cord, and sealing between the tire and the wheel rim is achieved by a design that requires no rings or grooves in either tire or wheel, Goodyear says.

Battelle Institute Installing Cobalt-60 Gamma Source

As part of an expanding program of molecular energy research for industry, Battelle Institute, Columbus, O., is installing one of the country's largest gamma radiation sources for activating or "triggering" chemical reactions. Initially the source will consist of 2,000 curies of cobalt-60, with an ultimate planned capacity of 10,000.

This source will be available for contract studies about February 15, and it is expected that a wide variety of organic materials can be polymerized with radiation at low temperatures and pressures. Polyethylene and polystyrene have already been made in this fashion, and Battelle hopes to produce entirely new polymers through radiation-activated reactions.

Cross-linkages of long-chain molecules like plastics and rubber have been effected by radiation. In the case of rubber this formation is known as vulcanization and is accomplished by the addition of sulfur-containing compounds to the rubber. By irradiation it appears possible to vulcanize rubber without the addition of sulfur compounds.

Cross-linkages are also produced when previously polymerized plastics are irradiated, according to Battelle, and physical properties are modified. The softening point, particularly in the case of polyethylene, is enhanced, and the solubility in organic solvents decreases.

Suggestion Box Bonus $903,000 in 36 Years

The Firestone Tire & Rubber Co., Akron, O., has awarded $903,000 to employes for ideas on improvements in production, sales, and office operations since starting its suggestion system in 1918, according to L. J. Alger, manager of the firm's suggestion system.

During the past year the company has distributed $80,402.56 for 3,676 suggestions, an average of more than $21 per award.

During the 36 years, employes from the firm's 25 plants throughout the world and from its sales and office forces have submitted 178,000 suggestions, of which more than 53,000 have been adopted, he reported. The average annual number of submissions is about 12,000, with 3,600 being accepted wholly or in part—a percentage of 30.9. The nationwide rate of acceptance is said to be 26.9% for other companies.

The rate of participation by Firestone employes is also higher than the national average, Mr. Alger said, with 325 suggestions received annually per 1,000 employes, as compared to 217 for industry generally.

The suggestion system encourages employes to offer ideas for improving working conditions, quality, safety, and sales, and for economizing on operations and on material usage. Highest awards are given for ideas leading to improved operations and subsequent savings to the company.

Firestone Installs Tire Cord Equipment at Gastonia

Synthetic tire fabric being gum-dipped at Gastonia plant

Electronic tire cord tensioning and gum-dipping equipment were recently put into full-scale operation at The Firestone Tire & Rubber Co.'s textile plant at Gastonia, N. C. Designed and built by Firestone, the continuous-flow equipment gum-dips, stretches, and tempers the rayon and the nylon tire cord on a mass-production basis.

The equipment consists of a chemical mixing section, huge gas-fired multiple heat-treating towers, and banks of individually powered tension rolls. All parts are operated from a single electronic control center. A structure as high as a five-story building encloses the machinery into what is essentially a separate factory unit.

The gum-dipping process, impregnating the filaments of the tire cord with chemicals and liquid rubber, and giving firm adhesion between the plies and the tread, was introduced as an exclusive process by Firestone in 1920 when only cotton cords were used. The process was adapted to nylon and rayon fibers.

Firestone reports that the newly installed equipment is unique in the rubber industry since it is designed for processing both rayon and nylon.

National Packaging Show Slated for April 18-21

Thirty thousand American and foreign business executives are expected to attend the twenty-fourth National Packaging Exposition and concurrent Packaging Conference at the International Amphitheatre, Chicago, Ill., April 18-21, according to the American Management Association, New York, N. Y., sponsor of the event.

With 330 exhibitors already having reserved more floor space than that occupied by last year's record-breaking exposition at Atlantic City, N. J., still more records in attendance, area, and number of exhibitors are expected to be surpassed this year. A total of 375 exhibitors, employing 140,000 square feet of the Amphitheatre's New Exposition Hall and South Hall, is anticipated.

One of the nation's largest annual trade shows, the Exposition assembles the latest packaging equipment available for the $10-billion-a-year American packaging industry, as well as displays of materials and services. The entire exposition will be housed on the street-level floor of the Amphitheatre, an ideal situation, AMA says, made possible by the huge size of the structure.

The complementary Packaging Conference, also sponsored by the 20,000-member management educational association, will be held at Chicago's Palmer House during the same period and is expected to be attended by more than 1,500 packaging executives and technicians. The three-day program will reflect the increasing interrelation of packaging and marketing, and the tendency of American business to give packaging staffs representation in the highest council of management, AMA reports.

Industrial packaging and packing will be particularly stressed this year, with emphasis placed on the potential for greater efficiency and cost savings represented by the packaging of both consumer and industrial goods. Standardization, instrumentation, quality control, and the correlation of design in both the product and its package will be explored.

Another facet of the conference will be the delineating of the need of better integration of the packaging and marketing functions and for top-management support of the packaging section. New materials, new packaging procedures, and new sales concepts will be described. Companies to be represented on this program include U. S. Radiator Corp., General Foods Corp., and the Ternstedt, Buick, and A. C. Spark Plug divisions of General Motors Corp.

Richard Wellbrock, vice president of New Jersey Machine Corp., heads the exhibitors' advisory committee for the event. W. L. Romney, Procter & Gamble Co., is chairman of the group of 19 executives of AMA member companies which is planning the conference program. AMA staff members assigned to the packaging show include A. K. Thorn and John A. Warren.

Admission to both the exposition and conference is free.

Tests Find Bladder Fuel Cells Crash-Resistant

Flexible bladder-type fuel cells offer the greatest resistance to rupture and subsequent explosion and fire in the event of airplane crashes, a series of tests conducted jointly by United States Rubber Co. and the Civil Aeronautics Administration at the CAA's technical development and evaluation center at Indianapolis, Ind., has determined.

U. S. Rubber has been supplying test materials to the technical center since 1949. Such materials, of nylon and rubber, ranged from full-size fuel cells for catapult crash tests to circular panels, about 36 inches in diameter, for burst tests on a large compressed air-gun.

The first phase of the program involved the testing of full-scale fuel cells under crash conditions, simulated by the use of a catapult of the type found on aircraft carriers. Flexible bladder-type cells were found to possess sufficient strength to resist rupture and offered a reasonable and practical solution to the problem, U. S. Rubber reports.

The second phase of the testing program included burst tests of 32 materials with a large compressed air-gun to determine the strength, elongation, and energy-absorbing properties of each. As a result, four materials were selected for the full-size bladder cells used in the final phase of the tests. U. S. Rubber does not reveal the percentage composition of these four materials, but says that the ultimate test determinations will be released shortly.

Form Chicago-Allis Mfg. Corp.

Edward H. Ball, president of Chicago Belting Co., Chicago, Ill., has announced a consolidation with the firm's two subsidiaries, Allis Rubber Corp. and Allis Seal Corp. The new corporation will be known as Chicago-Allis Mfg. Corp. Purpose of the consolidation is to effect greater efficiency in the manufacture and sale of products, which include leather belting, industrial leather products, precision molded rubber products, and industrial shaft and face-type oil seals.

New Scott Testers Plant for Spartanburg, S. C.

Scott Testers (Southern), Inc., will erect a new plant at Spartanburg, S. C., the company announces, with completion expected in mid-February. The firm began operations there about two years ago as a repair and service center for equipment manufactured by Scott Testers, Inc., Providence, R. I. A stock of parts is maintained, and a staff of service personnel is available for on-the-spot repairs.

John E. Hargreaves is general manager at Spartanburg, and John Klinck is sales representative for Scott Testers.

Proposed Spartanburg plant of Scott Testers (Southern), Inc.

Makes Acrolein Dimer Group

The first large commercial production of a group of reactive intermediates—acrolein dimer and its derivatives, alpha-hydroxyadipaldehyde, hexanetriol-1,2,6, and tetrahydropyran-2-methanol—has been announced by Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., New York, N. Y. The small-scale production of these chemicals in the past did not make them economically feasible for industry, although they have been employed in the laboratory.

According to the company, acrolein dimer, with its aldehyde group of ethylenic linkage, is a valuable starting material for the preparation of synthetic resins and the synthesis of chemicals for textile finishing, paper treating, rubber compounding, and pharmaceutical and plasticizer manufacture.

Alpha-hydroxyadipaldehyde is being supplied as a stable 25% aqueous solution because of its high reactivity. Its three reactive groups make it an important intermediate for chemical synthesis and resin manufacture. As a dialdehyde, it is useful as an insolubilizing agent for proteins and polyhydroxy materials and as a cross-linking agent for polyvinyl acetal and polyvinyl acetate.

Hexanetriol-1,2,6 is an alkyd and polyester resin intermediate, as well as a softener, moistening agent, and solvent. Through reaction of its hydroxy groups it is useful in the preparation of plasticizers, polyurethane resins, foamed isocyanate resins, drying oils, and special low-temperature lubricants.

Tetrahydropyran-2-methanol, a specialty solvent, is also of interest in the preparation of plasticizers and pharmaceuticals.

Promotional Foam Mattress from U. S. Rubber

A promotional foam mattress with matching foundation, designed to give the retailer a mark-up ranging from 40-42%, has been added to the foam mattress line of United States Rubber Co., New York, N. Y. The mattress, full-size and 4½ inches thick, has quality woven stripe ticking permanently anchored to it.

$291,000 for Science Teaching in du Pont's 1955-56 Aid-to-Education Program

A fund of $291,000 for grants to universities and colleges to encourage the teaching of science and mathematics has been announced by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., as part of its $800,000 aid-to-education program for 1955-56.

The fund includes $75,000 for summer and winter fellowships for master's degree training for high school science and mathematics teachers; $125,000 to advance the teaching of chemistry in 50 privately supported institutions, mostly liberal arts colleges; and $91,000 for 24 post-graduate teaching assistantships in chemistry.

The grants for better teaching were introduced in recognition of a growing need of such assistance and were worked out in cooperation with educators throughout the nation, du Pont reveals. More than 100 institutions will be beneficiaries in the next academic year of these teaching grants, which in the past have been of an experimental nature, but are now the largest part of the company's aid-to-education program.

This full program also encompasses the granting of $279,000 for fundamental research, $210,000 for post-graduate fellowships in science and engineering, and the balance for miscellaneous functions. The 1955-56 figure of $800,000 is an increase of $100,000 over the '54-'55 donations.

Included in the authorization for research are grants-in-aid of $15,000 each to ten universities, $10,000 each to seven, and summer research grants of $1,500 each to 16 other universities. The purpose of these grants is to encourage unrestricted fundamental research in chemistry.

Under the long-established program of post-graduate fellowships in scientific fields, the company is awarding 57 for the next academic year, including 23 in chemistry, 17 in chemical engineering, six in biochemstry, five in physics, four in mechanical engineering, and two in metallurgy.

Du Pont will have no hand in the detailed administration of any of the grants, but will leave such decisions to the colleges and universities selected.

Rollway Roller Bearing Ups Capacity of 4½-Inch Extruder

A specially engineered thrust roller bearing, supporting a top load rating of 114,500 pounds at 67 rpm., has enabled the transmission of a 4½-inch extruder, manufactured by National Rubber Machinery Co., Akron, O., to handle a variety of extrusion loadings and materials, including rubber and plastics, according to Rollway Bearing Co., Syracuse, N. Y., maker of the bearing.

Although the general dimensions of the new bearing necessarily remained the same as those of the standard bearing previously used, the roller complement was altered completely. Roller diameters were increased ¼-inch, making the roller one-third larger than those of regular thrust roller bearings of similar dimensions. Roller slots were widened and lengthened, and their number decreased. A greater projected roller surface between the bearing plates resulted.

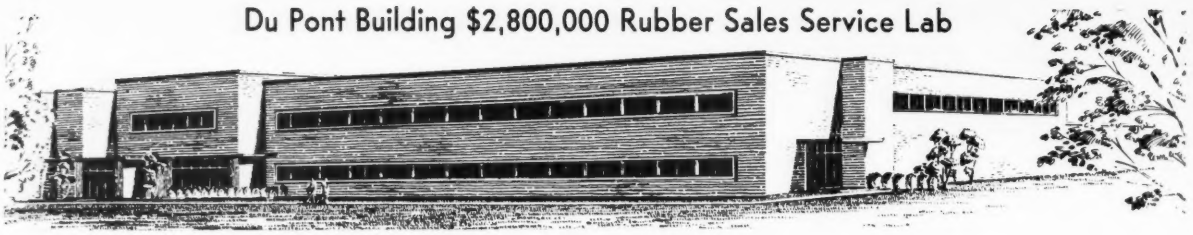
According to Rollway, its radial bearings support and locate the extruder transmission's three gear shafts. The high-speed shaft bearings and the intermediate-speed shaft bearings are steel cage-type metric series bearings. Completely separable, they are the floating type, having been press-fitted to the shaft and slip-fitted to the transmission housing.

Monsanto to Supply Adipic Acid

The availability in commercial quantities of adipic acid has been announced by the organic chemicals division, Monsanto Chemical Co., St. Louis, Mo. A raw material for nylon manufacture, it is also used to modify surface coating resins, imparting flexibility to the films and to polyester resins.

A reactive dibasic acid, it has recently been used in the manufacture of flexible isocyanate-foamed polyester resins and low-temperature ester plasticizers for PVC, cellulosics, and rubber. Monsanto's adipic acid is shipped in 50-pound bags.

Du Pont Building $2,800,000 Rubber Sales Service Lab



Proposed du Pont rubber sales-service laboratory being built at Chestnut Run, Del.

A new rubber sales-service laboratory costing approximately $2,800,000 is being built by E. I. du Pont de Nemours & Co., Inc., at Chestnut Run, near Wilmington, Del., the fourth laboratory constructed on the property since its was acquired two years ago.

A one-story, brick and steel building that will provide 62,000 square feet of space and accommodate more than 200 laboratory personnel, the new facilities will enable the company to broaden its sales-service activities which for the past 33 years have been conducted at its Deepwater Point, N. J., rubber laboratory. Construction of this new rubber sales service laboratory is expected to be completed in early 1956.

According to the company, the new laboratory will provide technical service in the application and use of such products as neoprene, Hypalon chlorosulfonated polyethylene, rubber chemicals, and Hylene organic isocyanates. Complete equipment for milling, calendering, extrusion, and vulcanization will be on hand. Separate areas will be available for isocyanates, cement, paper, dry polymer processing, latex, physical testing, and consumer product testing.

Diamond Alkali Erecting Radiation Research Lab

Construction of a new radiation research laboratory at the research center of Diamond Alkali Co., Painesville, O., has begun, according to A. W. Meyer, director of exploratory research. Expected to be completed in mid-February, the laboratory will explore the possibility of harnessing gamma rays for such chemical application as polymerization, oxidation, and chlorination.

Diamond believes it is one of the nation's first chemical companies to have a high-energy radiation source installed in its laboratories for industrial research. The Atomic Energy Commission has announced its encouragement of such activities which will help develop peacetime applications of atomic energy.

"One of the more important features of the laboratory will be a 1000 Curie radioactive cobalt irradiation source," Dr. Meyer revealed. "Radiation from this special cobalt source, fabricated for Diamond by AEC's Brookhaven National Laboratory, will be equivalent to the radiation from 2.2 pounds of radium which, presently, is almost one-half of the available world supply of refined radium."

Since 1953, the company has been one of three members of a nuclear power study team participating in the AEC's nuclear reactor development program. The two other companies are Foster-Wheeler Corp., New York, N. Y., and Pioneer Service & Engineering Co., Chicago, Ill.

A major task of the study team is to solve the problem of the ultimate use and disposal of highly radioactive fission products generated by a nuclear power reactor. Diamond's new laboratory is expected to contribute to the solution of this enigma.

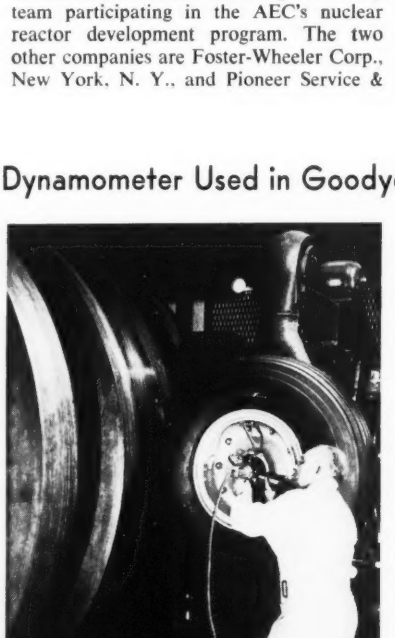
C. C. Brumbaugh, director of atomic energy in alkali and electrolytic products research for Diamond, first proposed such a study team to the AEC. He was assisted in the original planning of the project by H. E. Everson and W. J. Lightfoot. Dr. Everson is now aide to Dr. Meyer and will supervise research on radiation chemistry and special research in physical and inorganic chemistry.

113-Ton Brake Dynamometer Used in Goodyear Plane Labs

A wheel and brake dynamometer, described as the most modern and completely equipped machine used in the aeronautical industry for qualification tests of landing gear equipment, is the newest addition to a series of similar apparatus in the laboratories of the Goodyear Tire & Rubber Co., Akron, O., for solving problems involved in the decelerating of large, high-speed modern aircraft.

A 113-ton, 14-foot high machine, the dynamometer simulates airplane landing conditions with loads up to 60,000 pounds per wheel at speeds as high as 250 miles per hour. Automatic recordings are kept of the speed, stop time, torque, brake pressure, and other significant data required to determine test results, the Goodyear company reports.

The machine is made up of a huge flywheel to which individual steel plates, 10 feet in diameter, can be added to vary the flywheel weight as desired. The flywheel is brought up to the landing speed of the airplane, for which a particular tire wheel and brake are being developed, by means of a 200-hp. reversible motor.



Technician adjusting mechanism on tire before testing on dynamometer, left half of illustration

On each side of the flywheel is a separate loading carriage, each hydraulically operated by its own loading cylinder, upon which the tire, wheel, and brake assembly is mounted. By varying the pressure to these cylinders the wheel load can be accurately controlled.

When the exact speed required is reached, the tire is landed against the flywheel and the brake applied, decelerating the flywheel to a standstill and thus simulating the airplane landing condition. Temperatures in excess of 2,000° F. are created, heat capable of turning the brake disk surfaces into a semi-molten condition. No airplane normally sustains such operating conditions, Goodyear asserts.

Two separate tire, wheel, and brake assemblies can be tested alternately. The combination of the flywheel weight and speed can be varied to develop a kinetic energy up to 104 million foot-pounds. Loading carriages can accommodate tire sizes as large as 70 inches in diameter. The complete testing cycle can be set up to operate automatically on any time schedule desired.

Pennsalt Purchases Index Chemical Co.

Pennsylvania Salt Mfg. Co., Philadelphia, Pa. has acquired a major interest in Index Chemical Co., Houston, Tex., producer of synthetic ethyl and methyl mercaptans and dimethyl and diethyl sulfides. According to George B. Beitzel, president of Pennsylvania Salt, the activities of the Index firm will be integrated with the production and sales departments of Sharples Chemicals, Inc., a Pennsalt subsidiary and manufacturer of related synthetic organic sulfur compounds.

Index's new board of directors will consist of John T. Files, C. A. Dickey, L. H. Clark, H. F. Bjork, H. I. Cramer, R. W. Sloan, and G. T. Collins. Mr. Clark is the new president; Mr. Dickey and Mr. Bjork, vice presidents; J. F. Towle, secretary and treasurer; and T. B. Hudson, assistant secretary and treasurer.

Bedford-Bolling Co. Incorporates

Bedford-Bolling Co. has been incorporated to facilitate its new expansion program which includes the assumption of the used machinery business and some of the specialties of its parent company, Stewart Bolling & Co., Inc., Cleveland, O., manufacturer of rubber and plastic machinery. Stewart Norris Bolling, Stewart Bolling, and Edward Butler are the incorporators and will also serve as administrators. A new plant is being built in Bedford, O.

Hose Manufacture Aided by Aluminum Boxes

Perforated aluminum boxes are now being used by The Goodyear Tire & Rubber Co., Akron, O., for draining hot alcohol from freshly cut hydraulic brake hose. Made by Mutto Mfg. Co., Canton, O., the aluminum boxes are also valuable in checking quantity of production since they do not absorb alcohol. Previously, cardboard containers had been used, but these deteriorated rapidly and could not be employed in the weighing process because of their easy absorption of alcohol.

Stauffer Chemical Co. Builds New Crystex Plant

A new $800,000 plant for the production of Crystex, an insoluble polymerized allotropic sulfur, has been completed by Stauffer Chemical Co. at Monongahela, Pa. Designed and constructed by the firm's engineering department, the new continuous-flow facilities boost Stauffer's total output of the material, also made in other plants at Chauncey, N. Y., and Richmond, Calif.

Insoluble in all known solvents, allotropic sulfur is used extensively in the rubber industry where normal sulfur activity prior to curing results in undesirable blooming; this sulfur remains inactive until the curing temperature causes normal vulcanization.

First commercially produced by Stauffer in 1934, Crystex is said to result from the rapid chilling of molten rhombic sulfur in carbon disulfide. Crystex is estimated to have a molecular weight of several hundred thousand.

Rubber Roads for Rapid City, S. D.

Ten major business streets of Rapid City, S. D., have been resurfaced with a rubber compound-asphalt mixture after an evaluation of a test patch laid down for the Winter of 1953-54 had shown that 90% less cracking had developed, compared to other resurfaced streets.

The rubberized asphalt was laid down in an average thickness of 1½ inches and is expected to provide a strong, smooth pavement that can be maintained more cheaply than ordinary road mixtures, according to local officials.

Rubarite, the rubber compound used, is a free-flowing powder composed of unvulcanized synthetic rubber and barytes mineral, produced in Magnet Cove, Ark., by Rubarite, Inc., a company owned jointly by The Goodyear Tire & Rubber Co., The National Lead Co., and Bird & Son, Inc.

Rapid City, at the foot of the Black Hills, is in a winter resort area and is subjected to extreme cold and heavy snows for several months of the year.

NEWS BRIEFS

United States Rubber Co., New York, N. Y., has purchased a four-acre, 365-foot frontage piece of property from Cincinnati Chemicals Works, Inc., on Para Drive in Cincinnati, for the purpose of building a new branch office and warehouse to be used by its tires, mechanical goods, and footwear divisions in the area.

Rubatex Products, Inc., New York, N. Y., has licensed the following rubber manufacturers during 1954: American Rubber Products Corp., La Porte, Ind.; Dura Flex Co., Santa Monica, Calif.; Durkee Atwood Co., Red Wing, Minn.; Johns-Manville Corp., Chicago, Ill.; and Mechanical Rubber Products Co., Warwick, N. Y.

Hamilton Metal Products Co., Hamilton, O., contributed its Jolly Jugs, colorful jugs with drip-proof pouring spouts which encase a stopper hinged to the receptacle, as place-settings for the recent breakfast given by the United States Rubber Co. at the Conrad-Hilton Hotel, Chicago, Ill., in honor of the 4-H Congress.

The American Institute of Management has awarded Certificates of Management Excellence for 1954 to four American rubber products companies, including The Firestone Tire & Rubber Co., The B. F. Goodrich Co., and The Goodyear Tire & Rubber Co., all of Akron, O., and United States Rubber Co., New York, N. Y., in its sixth annual management survey.

Carlisle Corp., Carlisle, Pa., has purchased Stoner Rubber Co., Anaheim, Calif., leaving intact Stoner's name, personnel, and general manager, who is N. S. Von Rohr.

B. F. Goodrich Chemical Co.'s Louisville, Ky., plant, which produces Geon vinyl resins and Hycar American rubber, has worked 2,200,000 man-hours without a lost-time accident; the last disabling injury occurred in September, 1953.

Bacon Industries, Inc., Watertown, Mass., manufacturer of silicone rubber and Kel-F coated O-rings, has appointed Fred Peterson Co., Minneapolis, Minn., as its midwestern sales representative.

Paul M. DeSchryver has been named manager of the sales control department, mechanical goods division, United States Rubber Co., New York, N. Y. Formerly assistant manager of the footwear division's sales personnel department, he joined the company in 1938 as a junior auditor.

United States Rubber Co., at Mishawaka, Ind., has set a new world's record for safety in the rubber footwear industry, with its 5,500 employes working 7,412,636 man-hours without a lost-time accident, bettering by more than a million man-hours the mark set in 1946 by the St. Jerome plant of Dominion Rubber Co., Ltd., Canadian subsidiary of U. S. Rubber.

NEWS ABOUT PEOPLE

John H. Dillon, director of the Textile Research Institute, Princeton, N. J., will receive the Harold De Witt Smith Memorial Medal for 1955, the sixth such award by Committee D-13 on Textile Materials of the American Society for Testing Materials. The medal will be presented to Dr. Dillon at a luncheon in his honor on March 17 during the Committee's spring meeting, March 15-18, at the Hotel Statler, New York, N. Y. The medal is a testimonial to the memory of the late Harold De Witt Smith who pioneered in the concept of an engineering approach to the evaluation of the properties of textile fibers and their utilization. Dr. Dillon received his Ph.D. from the University of Wisconsin and joined the physics research group of the Firestone Tire & Rubber Co., Akron, O., in 1931, becoming head of the physics department in 1937 and assistant director of research in 1945.

Edward M. Lemon has been appointed West Coast representative of chemical sales, with headquarters in Los Angeles, Calif., for Barrett Division of Allied Chemical & Dye Corp., New York, N. Y., replacing **C. V. Fetty,** who will continue to handle cylinder ammonia sales. **Josef E. Windbiel** will assume Mr. Lemon's former responsibilities in the St. Louis territory.

C. A. Reed, assistant to the president of Seiberling Rubber Co., Akron, O., and associated with the company for 34 years, has retired. He will, however, continue to serve as a consultant on sales and policy matters. In point of service, he was the oldest Seiberling employee still active with the company.

Wallace H. Woodrow has been named a vice president by Hale & Kullgren, Inc., Akron, O. He is in charge of contract engineering work for the company. **Harry E. Tourtilotte,** formerly in charge of plant maintenance and construction for the chemical division of Monsanto Chemical Co., has been appointed a project manager. **Robert L. Guggenheim** has joined Hale & Kullgren and is in charge of machine sales.

Alvon R. Cox has been named technical manager of plastisol and bulb products at Plant 4 of The B. F. Goodrich Co. Industrial Products Division, Akron, O.

D. G. Gibson has been appointed district manager in the Dallas territory for The Timken Roller Bearing Co., Canton, O. He has served the firm since 1941.

Dwight R. Means, vice president of Columbia-Southern Chemical Corp., Pittsburgh, Pa., will reduce his work schedule to a half-time basis and will serve in various consulting capacities, transferring his relinquished responsibilities to **J. A. Neubauer,** technical director, and **R. L. Hutchinson,** former general superintendent and now general manager of operations. **C. K. Ballard** has been appointed manager of production and will be succeeded as works manager of the firm's Lake Charles, La., plant by **A. T. Raetzsch,** formerly superintendent of operations there. **N. J. Ehlers** has been named assistant technical director for the company.

William M. Gaston has been named manager of the New York office of the International B. F. Goodrich Co., succeeding **F. Elliott Wood,** retired. Associated with Goodrich since 1926, Mr. Gaston became manager of distributors' sales in the plastic materials sales division in 1947, and district sales supervisor in the international division's New York office in 1952.

Carl S. Hoglund has been elected president of R. D. Abbott Co., Los Angeles, Calif.

Norman J. Johnson has been appointed general manager of Griffith Rubber Mills, Portland, Oreg., and **Douglas Jones** has been named to take charge of the firm's export department. New sales chief for Griffith's marine specialty line is **Zan Wise.**

W. C. Dunlap has been appointed manager of purchasing for New Jersey Zinc Co., New York, N. Y., succeeding **W. J. Lee,** who has retired. **A. E. Turner** has been named assistant manager of purchasing.

Frank W. Judson, a 60-year veteran of the sales department of Pittsburgh Plate Glass Co., Pittsburgh, Pa., has retired. In 1935 he was elected a vice president of the firm. In 1953 top officials of the automotive industry in Detroit tendered Mr. Judson a testimonial dinner at which he was awarded the honorary title of "Ambassador of Friendship" between the glass and steel industries in Pittsburgh and the automotive industry in Detroit.

George Collins has been named sales manager of Hystrene and Industrene fatty acids for Trendex Division, HumKo Co., Memphis, Tenn. He was formerly with Atlas Powder Co.

Charles B. Roen has been named an assistant director of the research and engineering division of Monsanto Chemical Co., with headquarters in Dayton, O. He joined the company in 1946 after having served with Shell Chemical Corp.

Howard Fisher has become assistant chief chemist of W. J. Voit Rubber Corp., Los Angeles, Calif. He was previously with The Goodyear Tire & Rubber Co.

Peter W. Walkinshaw has been appointed plant superintendent for National Polychemicals, Inc., Wilmington, Mass. He was formerly associated with Carbide & Carbon Chemicals Co., Canadian Resins & Chemicals, Ltd., and Price Brothers & Co., Ltd.

Dickson Sheppard has been named technical superintendent of The Goodyear Tire & Rubber Co., Los Angeles, Calif., and his former position as chief chemist has been assumed by **Halsey Shepley,** former section chief.

William H. Cobb, Jr., has been named sales manager of Cordura high-tenacity rayon for the textile fiber department of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Richard B. Tucker has relinquished his position as executive vice president of Pittsburgh Plate Glass Co., Pittsburgh, Pa., and reduced his work schedule to a half-time basis. His former responsibilities have been assigned to **David G. Hill,** a vice president of the firm. Mr. Tucker will retain his title of vice president and will continue general supervision of glass research, foreign operations, and the export department.

Earl F. Boyle has been elected vice president, general manager, and a director of Van Cleef Bros., Inc., wholly owned subsidiary of Johns-Manville Corp., New York, N. Y. Also named vice president of Johns-Manville Sales Corp., Mr. Boyle has been with J-M since 1916.

J. E. Mayl, vice president and general manager of the films, foam, and flooring division of The Goodyear Tire & Rubber Co., Akron, O., has been honored for his completion of 30 years of service with the company.

Harry G. Hoehler has joined the sales staff of Witco Chemical Co., New York, N. Y., and will cover the Philadelphia and Baltimore territories.

Kenneth W. Scott has been appointed to the physics and electronics section of the Goodyear Tire & Rubber Co.'s research division, Akron, O.

Robert P. Beasley, with The Firestone Tire & Rubber Co., Akron, O., since 1937, has been elected assistant comptroller.

Eric Sutton

Stanley Raistrick

Frank T. Tucker

Wayne Churchill has joined Thiokol Chemical Corp., Los Angeles, Calif. He was formerly with Ideal Roller & Mfg. Co.

S. R. Zimmerman, Jr., has been elected vice president of Raybestos-Manhattan, Inc., Passaic, N. J., and **R. J. Gorecki** has been named a director of the company. Also elected were **H. H. Burrows** as vice president of rubber sales, and **R. B. Hazard** as sales manager of rubber and packing.

F. L. McNabb has been appointed manager of sales development of the Hycar and rubber chemicals department of B. F. Goodrich Chemical Co., Cleveland, O. Associated with Goodrich since 1935, he has held numerous positions in the general and research chemical laboratories and processing division.

C. G. Stupp, technical director of Barrett Division of Allied Chemical & Dye Corp., New York, N. Y., has been named vice president of the firm. He will continue to direct the company's research and development activities in the Edgewater, N. J., Glenolden, Pa., and Toledo, O., laboratories.

David W. Stapleton has been named executive vice president of Stowe-Woodward, Inc., Newton, Mass., manufacturer of rubber-covered rolls and mechanical rubber products for the paper and textile industries. He was formerly with Udylite Corp., Ainsworth Mfg. Co., and Standard Products Co.

E. H. Bluman has been elected to the office of vice president of the Harchem Division of Wallace & Tiernan, Inc., Belleville, N. J. He was formerly executive vice president of W. C. Hardesty Co., Inc., a wholly owned subsidiary of the firm. Before coming to the United States from his native Germany, Dr. Bluman was managing director of Vereinigte Stearinwerke, Hamburg, producer of fatty acids.

Stanley Raistrick, vice president and secretary of British Anchor Chemical Corp., New York, N. Y., has been recalled to take up a higher executive position with the parent company, Anchor Chemical Co., Ltd., Clayton, Manchester, England, and has been replaced by **Eric Sutton,** assistant sales manager of the firm since 1951.

Harry E. Smith, vice president in charge of rubber products sales of Raybestos-Manhattan, Inc., Passaic, N. J., and member of the board of directors and executive committee, has retired after 45 years of service with the firm. He rose through the ranks in various clerical, administrative, and sales capacities. A director of The Rubber Manufacturers Association, Inc., and a member of the U. S. State Department's rubber advisory panel, Mr. Smith has also been active in civic affairs; he was president of the Passaic Chamber of Commerce and is a member of the board of governors of Passaic General Hospital.

Alvin H. Tenney has been appointed manager of market research of Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., New York, N. Y. He will assist **R. L. Bateman,** recently named director of product development.

Louis D. P. Chevalley has been named a technical manager at Plant 4 of The B. F. Goodrich Co. Industrial Products Division, Akron, O., and will assume responsibility for calendering, sheeted tire repair and patching materials, rubber bands, pressure-sealing zippers, latex thread, and extruded goods. He first became associated with Goodrich in 1938 in its chemical laboratory.

William G. Levans, formerly of Parker Appliance Co. and Roberts Toledo Rubber Co., has joined the development and research section of Goshen Rubber Co., Inc., Goshen, Ind., manufacturer of O-rings and custom-molded parts for industry, as a part of the firm's expansion plans for its production and laboratory facilities.

Frank T. Tucker has been made assistant to the president of The B. F. Goodrich Co., Akron, O. He joined Goodrich in 1919 and held various sales and advertising positions until 1929, when he became director of advertising for the company's retail stores. In 1940 he was appointed director of advertising for the company.

Jim Butler, formerly with Fullerton Mfg. Co., has become a member of the staff of Plastic & Rubber Products Co., Los Angeles, Calif.

O. K. Ames has been made manager of the trade relations department of Goodyear Tire & Rubber Co., Akron, O., and **Stephen A. Zeh** has been named senior staffman of the department, a post last held by Mr. Ames.

Norman F. Heydinger has been appointed manager of the sales statistics department of Seiberling Rubber Co., Akron, O., succeeding **Edward Ahern,** who will continue his association with the firm on a part-time basis.

William I. Burt, vice president-manufacturing of B. F. Goodrich Chemical Co., Cleveland, O., has been elected president of Goodrich-Gulf Chemicals, Inc., succeeding **William S. Richardson,** president of The B. F. Goodrich Co., who will continue to be a member of the board of directors of the jointly owned organization. Mr. Burt, with Goodrich since 1927, is a former president and director of the American Institute of Chemical Engineers.

Lester D. Bigelow, a vice president of Hewitt-Robins, Inc., Stamford, Conn., and sales manager of its rubber and conveyors divisions in the central and south central sales regions, has retired. A 50-year veteran of the rubber industry and a one-time semi-professional baseball player, he became associated with Hewitt-Robins in 1932 after having worked for Mechanical Rubber Co. and New York Rubber Corp.

FINANCIAL

Boston Woven Hose & Rubber Co., Boston, Mass. Quarter ended November 30, 1954: net profit, $61,349, equal to 11¢ each on 344,000 common shares, contrasted with net loss of $93,910 in the '53 quarter; net sales, $3,920,326, against $3,565,416.

Dayton Rubber Co., Dayton, O., and subsidiaries. Year ended October 31, 1954: net profit, $1,152,411, equal to $1.80 each on 587,652 common shares, contrasted with $1,751,735, or $2.82 a share, a year earlier; net sales, $55,923,543, against $62,086,818; federal income taxes, $1,177,709, against $1,818,692; current assets, $20,044,288, current liabilities, $9,470,670, against $19,437,626 and $8,601,448, respectively, on October 31, 1953.

Dow Chemical Co., Midland, Mich., and subsidiaries. Six months to November 30, 1954: net earnings, $16,551,869, equal to 71¢ each on 22,651,010 common shares, compared with $16,763,554, or 71¢ a share, in the 1953 period; net sales, $222,096,806, against $212,698,400.

Firestone Tire & Rubber Co., Akron, O., and subsidiaries. Year ended October 31, 1954: net income, $40,509,944, equal to $10.04 each on 3,998,292 common shares, compared with $46,748,971, or $11.77 each on 3,938,062 shares, in the preceding fiscal year; net sales, $916,047,040, against $1,029,402,035; income and excess profits taxes, $41,000,000, against $47,400,000; current assets, $393,108,677, current liabilities, $92,405,128, compared with $391,970,582 and $98,633,085, respectively, on October 31, 1953.

The Glidden Co., Baltimore, Md. Year ended October 31, 1954: net profit, $7,093,043, equal to $3.09 each on 2,293,455 common shares, compared with $7,109,272, or $3.10 each on 2,290,794 shares, in the preceding fiscal year; net sales, $209,083,579, against $211,758,522.

Hercules Powder Co., Wilmington, Del. For 1954: net income, $14,140,070, equal to $5.10 a common share, against $11,680,854, or $4.20 a share, in 1953; net sales, $187,547,566, against $190,202,417.

Lee Rubber & Tire Corp., Conshohocken, Pa., and subsidiary. Year ended October 31, 1954: net income, $1,400,295, equal to $4.97 each on 281,425 capital shares, contrasted with $1,674,128, or $5.94 each on 278,398 shares, in the preceding fiscal year; net sales, $39,385,382, against $46,302,361; federal income taxes, $1,523,000, against $1,877,400; current assets, $21,559,631, current liabilities, $3,666,339, against $19,999,086 and $3,124,461, respectively, on October 31, 1953.

OBITUARIES

John A. Britton, Jr.

John A. Britton, Jr., a leader in the petrochemical marketing field, a well-known figure in the rubber industry, and former president and director of Enjay Co., Inc., a Standard Oil of N. J. affiliate, was stricken by cerebral arteriosclerosis and died December 16 at his home in Short Hills, N. J.

He was born December 9, 1888, in Oakland, Calif. Mr. Britton was graduated from St. Matthews Military Academy and the University of California.

He began his business career with the Pacific Gas & Electric Co. and, after serving as manager of the Manila and Shanghai offices of John Rothchild Co., joined Standard Oil Development Co. in 1920. He entered the sales field in 1936 with the parent company and was made vice president and director of Standard Alcohol Co. in 1944. Standard Alcohol later became the Enjay Co., and Jack Britton became vice president in charge of sales of synthetic rubber and oil additives in 1948, and president in 1953.

The deceased was a member of many business, technical, and social organizations including the Society of Automotive Engineers, Oil Trade Association of New York, 25-Year Club of the Petroleum Industry, several local groups, Chi Psi fraternity, Masons and Knight Templars, and the California Club of Los Angeles, until his retirement from business in December, 1953.

Funeral services were held in Springfield, N. J., and cremation followed at Rosedale Crematory & Cemetery, in Orange, N. J. The remains rest at Mountain View Cemetery, Oakland, Calif.

Mr. Britton leaves a wife, a son, a grandson, and a brother.

Louis A. Tomka

Louis A. Tomka, supervisor of technical service, chemical division, Metal & Thermit Corp., Rahway, N. J., died January 4, following cranial surgery.

He was born July 25, 1910, in New York, N. Y. He was graduated from New York University.

After having been associated with Pantasote Corp., Harte & Co., and Rand Rubber Co., he joined Metal & Thermit's chemical sales department.

A memorial service was held in Gray's Funeral Home, Westfield, N. J., on January 6, followed by interment in Westfield's Fairview Cemetery.

Mr. Tomka is survived by his wife and two children.

George D. Freestone

George D. Freestone, assistant treasurer of The Rubber Manufacturers Association, Inc., died of a heart ailment on January 5, in Baldwin, N. Y.

He was born on December 24, 1906, in Brooklyn, N. Y. After graduation from the public schools, the deceased attended Pace Collegiate Institute, New York University, and the American Institute of Banking.

Prior to joining the RMA in 1942, Mr. Freestone was associated with the Brooklyn Edison Co. from 1922 to 1929 and the Bank of the Manhattan Co. of New York from 1929 to 1942. He was an assistant secretary of the RMA until 1952 and from that date held the position of assistant treasurer, serving on the statistical committee, general accounting committee, tax committee, and the sales research committee of the Association's tire division.

Mr. Freestone was active in church and community activities in the Nassau County, New York, area and was a member of the St. Andrew's Society of the State of New York.

Surviving are his wife, a son, a daughter, a grandson, and three sisters.

Funeral services were held in Fairchild Sons chapel in Garden City, L. I., on January 7, followed by burial in Greenwood Cemetery, Brooklyn, on January 8.

James E. Skane

James E. Skane, an engineer and executive of the Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, N. J., died December 15 after a prolonged illness.

Born March 19, 1891, in Oldham, England, Mr. Skane came to this country and attended Brown University, from which he graduated in 1916 with a degree in mechanical engineering.

He started with Manhattan in 1920 as a laboratory rubber specialist and did work on rubber compounding and textile improvement. He later became a sales engineer on rubber specialties. During World War II he served with the office of the Rubber Director, U. S. Department of Commerce, in Washington, D. C.

Funeral services were held December 18 at St. Clare's Church in Clifton, N. J., and burial took place in Providence, R. I., on the same day.

Mr. Skane is survived by his wife, a daughter, a son, and four grandchildren.

Harry W. Trump

Harry W. Trump, southwest district manager of the industrial division of The Timken Roller Bearing Co., Canton, O., died on Christmas Day in Baylor Hospital, Dallas, Tex., after a one-month illness. He was 63.

Associated with Timken since 1927, he had held his Dallas post since 1935.

Mr. Trump was a graduate of Ohio State University and a veteran of World War I, during which he saw service in the United States and France. He was also a member of the American Legion.

News from Abroad

Germany

D.K.G. Meeting Includes U.S.A. Papers

The annual general meeting and conference of Deutsche Kautschuk Gesellschaft were held October 21-23 in Munich. Specialists from the United States, Great Britain, France, Italy, the Netherlands, and Austria presented the following papers:

"Natural and Synthetic Rubber in Competition." P. Kranzlein, Huls.

"Cold Rubber." P. Orth, Huls.

"Limits for the Use of Silicon Rubber in Comparison with Some Heat-Resistant Organic Elastomers." J. Peter, Leverkusen.

"Colloidal Phenomena in Latex from Neoprene and Other Synthetic Rubbers." H. K. Livingston and G. W. Scott, Wilmington, Del., U.S.A.

"Special Types of Latex Foam." J. W. F. van 't Wout and A. J. de Vries, Delft, Netherlands.

"Contribution to the Improvement of Foam Rubber Processes." G. Sinn, Leverkusen.

"Identification of Vulcanization Accelerators by Paper Chromatography." J. W. H. Zijp, Delft.

"Protection of Rubber by the Deactivating Effect." G. Giger and J. Le Bras, Paris, France.

"Vulcanization of Rubber by Thiuram Disulfides." W. Scheele and O. Lorenz, Hannover.

"Rapid Determination of Sulfur in Natural and Synthetic Rubber Vulcanizates by Semi-Micro Volumetric Analysis." B. B. Bauminger, Birmingham, England.

"Quantitative and Qualitative Determination of Fillers in Vulcanizates." E. Endter, Hannover.

"Problems of Physical Testing of Vulcanizates," P. Kainradl, Vienna, Austria.

"Apparatus for Dynamic Measurements of Hysteresis and Shear Modulus of Vulcanized Rubber." A. Angioletti, Milan, Italy.

"Static and Dynamic Deformation Properties of Vulcanized Rubber and Other High Polymers." R. Ecker, Leverkusen.

"Dynamic-Mechanical Properties of Rubber Compounds." S. de Meij and G. J. van Amerongen, Delft.

"Tear Growth and Tear Testing in Natural Rubber and Synthetic Elastomers." R. Kaiser, Hannover.

"Secondary Structures ("Sekundärstruktionen") in Rubber Vulcanizates." H. Pohle, Leverkusen.

"Studies on the Abrasion of Vulcanizates." W. Scheele.

"Ozone Cracking in Rubber. Methods and Results." B. J. C. van Pul, Delft.

"Use of Reinforcing Silicic Acid Fillers in the Rubber Industry in the United States." R. F. Wolf, Baberton, U.S.A.

"Theoretical Calculations and Experimental Measurements of the Dynamics of Tennis Balls." A. Chiesa, Milan.

"Effect of Construction on the Static and Dynamic Properties of Tire Cord." P. Kainradl and F. Handler, Vienna.

"Further Investigations on Natural Rubber Tires." H. I. C. de Decker and C. J. van Amerongen, Delft.

"On the Statics of the Pneumatic Tire." W. Hofferberth, Hochst, Odenwald.

"Tire Noises—Vehicle Noises." H. Luetgebrune, Hannover.

"Procedures for Judging the Dynamic Fatigue Behavior of Tires." W. Kern, Munich.

"The Holofol Process. Its Development, Possibilities and Use." W. Opavsky, Coburg.

Plastic and Rubber Products at Hannover Fair

The Industrial Fair held at Hannover, April 25 to May 4, 1954, revealed a growing interest by rubber manufacturers in the utilization of foamed materials—both rubber and plastics—Vulcollan and silicones, and plastics in general. It seemed as though no important producer of rubber hose had neglected also to make plastic hose and tubing; Vulcollan, a rarely seen novelty at the Fair last year, found application by a number of firms making mechanical goods of various kinds.

Among the companies presenting foamed latex and Moltoprene (foamed Vulcollan) in the form of mattresses, upholstery materials, toys, insulations, etc., was Metzeler, A.G., Munich.

A wire-reinforced endless cog-belt of Vulcollan, designed for synchronized energy transmission in cases where the tension of the drive belt cannot be regulated, was featured by Continental. Its display of rubber goods included a two-part rubber door opening in both directions, for use in factories to permit vehicles to pass from one section to another without stopping. The heavy rubber sheet panels are provided with plastic windows and are mounted in metal frames having adjustable hinges to permit easy passage of larger vehicles, up to almost the full width of the door. The company also showed inclined conveyor belts.

Inclined and trough conveyor belts and new flame-resistant belts drew attention at the Phoenix stand, as did a series of heavy-duty rubber-to-metal bushings for all kinds of machines. These bushings have now been standardized and are delivered in any required size for lever deflection angles up to 30 degrees.

The leading manufacturers of plastic materials seemed chiefly concerned with polyester resins, foamed polyurethanes, and silicones. Farbenfabriken Bayer is concentrating on discovering new uses for its Leguvals—glass-fiber reinforced polyester resins. The firm exhibited a Leguval boat which, although about 16½ feet long, weighed only 12.5 kilograms (about 27½ pounds). Bayer is understood to be considering reinforced plastics also for large containers for the chemical, oil, and fuel industries and is already testing smaller containers for these purposes. Laminates of Leguval with wood, foamed materials, and cement stone were on view.

Other products were two silicone oil mold-release materials. In certain cases these products can be added directly to plastics, as PVC, to facilitate mold release and improve appearance as well as surface and electrical properties. Bayer is now producing silicone rubbers under the name of Silopren. The company also demonstrated the properties of Moltoprene and its combinations (Duralumin-Moltoprene) and of the Vulcollans, in various tests.

Incidentally, it was recently revealed that new developments on Vulcollans promise that before long it may be possible to process them like rubber, that is, in intermediate stages, for storage until needed for further treatment.

Badische Anilin & Soda Fabrik featured Lupolen H, high molecular polyethylene and improved polystyrenes, including a transparent type; the use of glass-fiber reinforced casting resins for making sail boats was demonstrated, also a new flexible casting resin which can be mixed with the hard type to yield products with a high degree of toughness and elasticity.

Farbwerke Hoechst, A.G., has continued to develop Hostaflon (polytrifluoromonochloroethylene) and now supplies it in granulated form in addition to the powder and dispersion.

Dynamit, A.G., has also taken up the production of polyesters, reinforced and otherwise, also a Vulcollan-based plastic with high resistance to wear and abrasion, intended for linings and special parts of apparatus.

Several firms demonstrated the application of deep drawing and vacuum forming to their respective plastic products.

New Thiuram Analysis Method

In the course of investigation of the mechanism of rubber vulcanization by thiuram disulfides in the presence and absence of sulfur, two new methods of quantitative determination of thiuram compounds were developed at the Technical Institute of Hannover.[1]

Conductometric titration of thiuram disulfide with copper sulfate in the presence of hydroquinone in aqueous acetone solution had already been proved possible; the method worked also in the presence of dithiocarbamate, but not in that of thiuram monosulfide. The new procedures, however, are effective in the latter case as well.

In the first method thiuram disulfide is converted to thiuram monosulfide by reacting with excess KCN, and the thiocyanate formed is determined by argentometric conductivity titration. This is a delicate procedure, requiring much experience. The second and simpler method is to determine the tetramethyl thiuram disulfide as dithiocarbamate, after reaction with dodecyl mercaptan, by conductometric titration with acid.

It is added that the Institute's conductometric analyses have already proved their worth in examinations of vulcanizate extracts in connection with the work on vulcanization with thiuram disulfide already mentioned.

1 "Kautschuk u. Gummi," 7, 6, WT 122 (1954).

Synthetic Rubber Production Increase?

Plans for the large-scale production of synthetic rubber in Germany were reported by P. Baumann, head of Huls Chemical Works, at the general meeting of the Association of the German Rubber Industry, held in Baden-Baden, June 20-30.

Since the Government of West Germany had decided against the French proposal whereby France would supply alcohol for the production of synthetic rubber in Germany, Huls began considering two projects for making 30,000 tons of synthetic rubber annually from petroleum materials. In the first case, 46,100 tons of n-butane would have to be imported annually from the United States at a cost of 14,800,000 DM; for the other, 192,500 tons of crude oil, to cost 21,200,000 DM, would be needed. The n-butane process, including cost of new plant, would require capital of 130,000,000 DM, against 164,000,000 DM if crude oil were the starting material.

The price at which the synthetic rubber could be sold, however, would be about the same in both cases, 2.92 DM per kilogram for the first, and 2.96 DM for the second, which compares with 2.55 DM per kilogram, c.i.f. Hamburg, for synthetic rubber imported from the United States. The prices are based on costs including normal taxes and charges, and it is understood that aid might be forthcoming from the government which would permit a more competitive price. It was also learned Huls would have access to latest American developments in cold rubber.

New Plasticator for PVC Announced

A new type of gelling or plasticizing machine for PVC, claimed to have advantages over both the usual roll mills and screw presses, has been developed by engineers of Wacker Chemie, Munich, working in close collaboration with the machinery builders, Werner & Pfleiderer, Stuttgart.

In this device, a conical rotor turns in a stationary conical housing; both are heated to working temperature, after which heat supply is cut off. The PVC and plasticizer mix is fed into the adjustable gap between housing and rotor by laterally arranged screws. The gap, unlike the linear space in a roll-mill, has planes, and internal friction causes gradual heating of the compound and gelation. The process is continuous and once plasticization is accomplished, the material seeks to leave the conical gap, assuming in its final stages in the machine the form of a round strip 3-10 millimeters in diameter. The entire process from the time the material is fed to the screws to discharge of round strip takes about one minute.

Proper adjustment of the gap and speed of the screws is essential; if the gap is too wide, powder will issue at the outlet; if too narrow, the strips become overheated and stick together. The plasticator is simple to operate, requires very little power and space; it is safer than mixing rolls, and operators are not troubled by heat; it can be brought to temperature rapidly and output is higher, it is also claimed. There is no danger of overheating, but the main advantage claimed is the low thermal strain on the material during plasticization. In the discussion of the heat and energy problems involved, it is pointed out that with this machine an approximate calculation is possible of the exothermic phenomena during gelation for different types of PVC, in relation to K value and plasticizer content.

New Radiation Gage[1]

A new German non-contacting radiation gage for measuring thickness or weight of sheet material of rubber, plastics, etc., utilizes beta rays of radioactive Thallium 204 and is equipped with an ionization chamber instead of counter tubes, crystal counters, or the like, for indicating radiation differences.

This gage consists of three parts: the U-shaped gage itself; a control unit with switch, deviation indicator, and a scale, in gms. m^2 for fixing the required value; and finally an amplifier provided with a warning system to indicate when tolerances are exceeded, and an ink recorder.

On the open end of the lower U-stem of the gage is the ray emitter, and directly opposite on the upper stem, is an ionization chamber which picks up the radiations permitted to pass through the material being measured. An ionization current is set up which produces a drop in potential at the built-in resistance. The difference between this drop and a counter-voltage, adjustable via the control unit, is measured by an electrometer and is indicated as deviation from the required value on a moving coil instrument. The ionization current is very feeble and must first be amplified before it can be utilized to indicate the measured surface weight, from which in turn the thickness is derived. The method of calculating thickness by means of the graphic representation of the strength of the radiations as a function of the surface weight is explained.

The frame of the gage is equipped for transverse motion, and sheets up to eight meters wide can be measured. The device is said to be foolproof, and if conversion tables, indicating the thickness for given surface weight and specific gravity, are provided for use in adjusting the scale of the control unit, specially trained personnel is not required to attend the gage, the manufacturer further claims.

The apparatus can be employed for a large number of purposes in all industries where sheet is continuously produced; in suitable combinations, it can also be used for special purposes. Thus in combination with a special reflex-radiation measuring method, surface weight measurements can be determined in places where irradiation of material is impossible, for instance in measurement directly on calender rolls. Other advantages claimed for the device are accuracy over a wide measuring range, low maintenance costs, and little wear to speak of.

Further developments are in progress aiming at increasing measurable surface weight beyond 20,000 gms. m^2, but for this purpose, the beta rays of radium combined with gamma rays from the radium disintegration series will be used instead of the beta rays of Thallium 204.

Present-Day Perbunans

The butadiene-acrylonitrile rubbers, marketed under the name Perbunan, were developed in Germany before World War II by the former I. G. Farbenindustrie. Manufacture of these rubbers was prohibited by the occupation authorities after the war, until 1951 when Farbenfabriken Bayer was permitted to resume production. What the firm has done along these lines since 1951 was revealed in a paper on oil resistant rubber, read by G. Fromandi, February 13, before a meeting of the Working Association of the Berlin Rubber Industry.[2]

At present five types of Perbunan are made: Perbunan 2818 and 2810 (known as Perbunan and Perbunan W, respectively) have a nitrile content of 28% and show a relatively high level of elasticity. Perbunan 3310 (Perbunan Extra) has a nitrile content of 33%, similar to that of certain American and Canadian nitrile rubbers. Perbunan 3810 (Perbunan Extra N) and Perbunan 3805 (Perbunan Extra NW) contain 38% nitrile and in this respect correspond to Hycar OR-15[3] and Polysar NP 450,[4] among others. The series is to be completed by the addition of a

1 "Kautschuk u. Gummi," 7, 7, WT 157 (1954).
2 Ibid., WT 127.
3 B. F. Goodrich Chemical Co., Cleveland, O., U.S.A.
4 Polymer Corp., Ltd., Sarnia, Ont., Canada.

type having properties like those of nitrile rubber prepared by the cold process; furthermore production is to be resumed of a very low viscosity, "fluid Perbunan," which had been developed during the war and is now apparently meeting with renewed interest.

By themselves, Perbunans are not good electrical insulators, but when combined with phenol resins of the Vulkadur A type, they are useful for various electrical purposes where oil resistance is at the same time required.

There is interest in Germany also in combinations of nitrile rubbers and PVC, and Perbunans 3810 and 3805, as well as the "fluid Perbunan," have been developed by Bayer, whith this use in mind.

Bayer is also producing nitrile rubber latices for use in paints, as binder for ground rubber, cork, textile fibers, in the production of leather compositions, floor coverings, insoles, etc., and with quartz, asbestos, china clay, and the like, for making oil resistant packings and brake linings. These latices cannot be employed for dipped goods. But during the war the former I. G. Farbenindustrie developed a Perbunan Extra latex of 45% concentration, with tensile strength of 250 kg/cm^2 with which oil resistant dipped goods were made in the usual way, and Bayer expects shortly to put on the market a latex of this type containing a non-fading stabilizer.

Conventions Scheduled

The European Federation for Chemical Engineering, formed by 19 technical and scientific societies from 11 European countries, will hold its 1955 Congress in Frankfurt a.M., from May 14-21, 1955, at the same time as the Achema XI-Chemical Apparatus Equipment Exhibition and Congress.

Malaya

Mixed Reaction to Higher Natural Rubber Prices

Frank elation among most, cautious optimism among the thoughtful, describe the reactions here to the happy turn rubber prices have been following in recent months. The caution is motivated by the fear that prices will be forced up to a level where an increase in the use of synthetics and more intensive research to improve them in America will be the inevitable result. There are constant warnings to this effect as well as equally persistent reminders that natural rubber too must press research if it is to hold its own against synthetic, and the recently announced American synthetic with the properties of natural rubber has been cited as offering the latest and most convincing proof of the urgency of the situation.

But those who refuse to be scared by synthetic rubber (with high prices for natural prevailing) into backing long-term research have found a God-given argument in their favor—the announcement that Goodrich has acquired a 600,000-acre concession for planting rubber in Liberia. They have seized on this piece of news not only as a sign of the faith in natural rubber that Americans themselves have, but as a justification for their own view that synthetic rubber can never take the place of natural rubber and that statements on improved synthetics are merely samples of sensation-mongering by American interests bent on depressing prices.

An item in the local press toward the end of the year about a plan, apparently having American as well as European backing, for investing millions of dollars in the rubber and other plantation industries in the Far East is not calculated to change the minds of those who see a bright future for natural rubber.

It seems that a Norwegian financier and economist, Rolf Stenersen, who represents Stenco, an Oslo finance and stockholding company, F. L. Rothschild, of New York and W. Willems, of Amsterdam, Holland, recently arrived in the Far East charged with the mission of inducing Indonesia to agree to join a new finance scheme for the planting industries in the East, according to which foreign investors would wholly finance rubber, copra, palm oil, and other tropical products and receive as their share ⅓ to ¼ of the whole crop, the remainder going to the producing country. Some of the advantages claimed for the scheme are that this new flow of capital would solve local unemployment problems, while foreign exchange difficulties would be avoided. The principals whom he represents, Mr. Stenersen apparently stated, have millions to invest; they would prefer to operate in Sumatra, but if Indonesia rejects their proposition, they may turn to Malaya.

Labor's Bonus

Malaya's rubber plantation workers entered the new year happy in the knowledge that their wage rates during the first quarter of this year would be two notches higher in the wage scale than at the close of 1954. The new wage agreement, now in effect, not only fixes the daily minimum for field workers at $2.05 and adds 5 cents to the former daily pay for tappers, but gives contract tappers 15 cents more a day, check-roll tappers 10 cents, and field workers 5 cents, for every increase of 10 cents in the price per pound of rubber. Since the average price for October-December, 1954, had been more than 80 cents, the wage scale at prices between 80-90 cents per pound applies, which is two zones above the rate prevailing in the preceding quarter when prices were between 60 and 70 cents a pound, and adds a further 30 cents daily to the pay of contract tappers, 20 cents to check-roll tappers, and 10 cents to field workers. Including the cost-of-living allowance of 80 cents a day, the present daily rate for the three categories is $3.00, $2.65, and $2.15, respectively against $2.65, $2.40, and $2.05, respectively, in the preceding quarter. Field workers, it is noted, now are paid three times as much as in 1946, when the first rubber union came into existence here.

How Mudie Taxation Would Work

The Government of Malaya has up to the present writing done nothing about the Mudie Report. At the time it was published the report was sharply criticized for the compulsory nature of its replanting scheme and its harsh recommendations on taxation and fund raising.

The report is still the target for occasional barbs; the latest, mentioned editorially by the *Straits Times* of December 11, 1954, came from Sir Andrew McFadyean who attacked the proposed rate when the price of rubber should be more than $1 (Straits) per pound, displaying what, at the prevailing price level, seemed to the paper to be premature concern. Indeed, few could have foreseen at that date that by the end of the year the price for rubber would have soared to within a few cents of the dollar level, and consequently that if the Mudie scale of duty and replanting cess had been in force, rubber growers would have started the year by paying an export duty of 17 cents per pound, plus the cess of 4.5 cents per pound, altogether 21.5 cents per pound, with the prospect of having to pay up to 71.5 cents per pound in the event rubber did manage to touch the $2 mark.

The contemplation of what it has escaped will hardly make the local rubber industry, already hostile to the provisions of the Mudie plan, any more ready to accept them.

Tubeless Tires Available

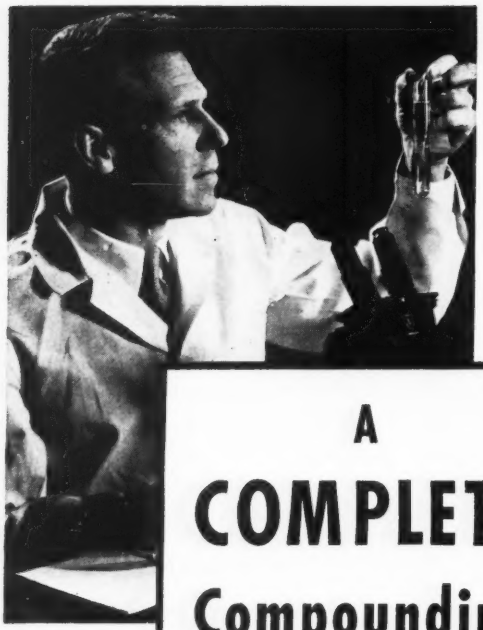
At least two tire manufacturing companies in the Far East have their eyes on Malaya as a prospective buyer of tubeless tires. Yokohama Rubber Co., Ltd., Japan, which began producing tubeless tires last July, is prepared to supply such tires to Malaya immediately, the export manager of the concern reportedly stated on his visit to Singapore at the end of last year, adding that the company obtains 70% of its rubber from Malaya.

Goodyear Tire & Rubber Co., Ltd., Bogor, Java, which began to make tubeless tires last June, was scheduled to introduce these products into Malaya at the end of 1954 through its local selling company. The Bogor factory is now producing 2,000 tubeless tires a month. The firm also makes 29,000 ordinary automobile tires and 275,000 cycle tires, monthly.

Rubber in Paper Bags

Paper bags for packing rubber for export, made by Veth's Papieren Zakkenfabriek, N.V.,[1] Amsterdam, Holland, are now also being sold in Malaya, and toward the end of last year, the first shipment of two tons of first-grade smoked sheets and crepe left Singapore for Hamburg, Germany. The local agents for the Dutch firm report that more than 10% of their stock of bags has been taken by packers and estates here.

1 See our Jan., 1955, issue, p. 533.



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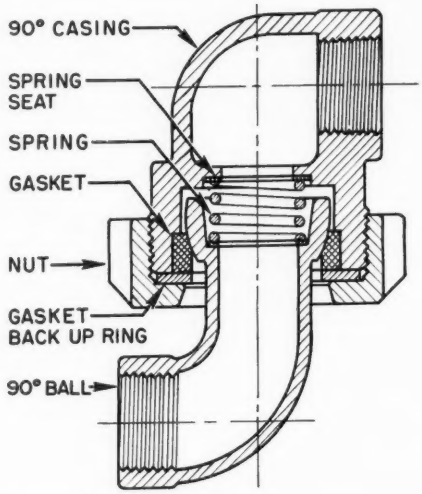


Cross-section view of Barco Series 600 Type S Swivel Joints

High-Pressure Barco Swivel Joints

A new series of swivel joints for high-pressure and high-temperature applications has been announced by Barco Mfg. Co., Barrington, Ill. Known as Barco Series 600 Type S Swivel Joints, they are available in a complete range of sizes from ½-2 inches, in four styles. All sizes have malleable iron casing and steel ball, with the 1½-inch and two-inch sizes having a steel nut and being furnished in all-steel construction upon special order.

According to the company, the 1½-inch and two-inch swivel joints, when equipped with Barco 11 MS all-metal gaskets, are suitable for working pressures up to 2,000 psi. and are recommended for hydraulic applications on die casting and plastic injection machines where protection against blow-outs is essential.

The joints are said to feature a self-alining design which simplifies and speeds up pipe fitting, automatically eliminates binding, and guards against wear.

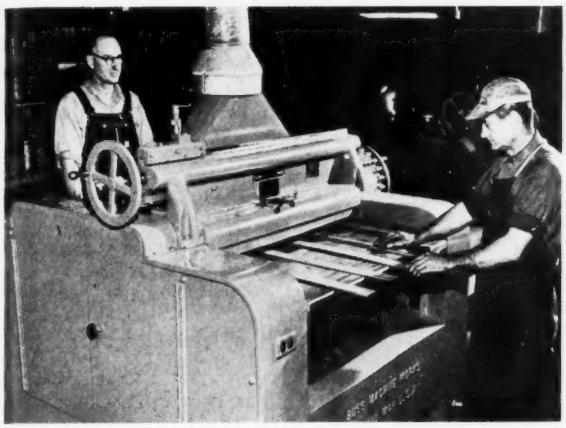
Planer with Carboloy Knife

A woodworking-type planer, designed to make use of a 40-inch solid-cemented carbide knife and expected to cut costs for manufacturers of rubber and plastic tile, shoe soles, and brake linings, has been introduced by Buss Machine Works, Holland, Mich. Called the Micro Surfacer, the machine is an adaptation of the firm's single-surface wood planers to the planing of abrasive and flexible materials.

Constructed so that stock-transferring conveyors can be built in, the Micro Surfacer is equipped with safety devices such as shear pin and coupling in the feed drive, micro switches, and electrical equipment, such as heaters.

The carbide knife, developed by the Carboloy department of General Electric Co., is said to be much stronger and longer lasting than the steel knives formerly used. Held mechanically in the cutter head by means of wedges, the Carboloy knife is highly resistant to shock and is capable of close tolerances and clean severing action which results in surfaces free from dust and grit, according to Buss Machine Works.

This accuracy, the company adds, saves the manufacturer

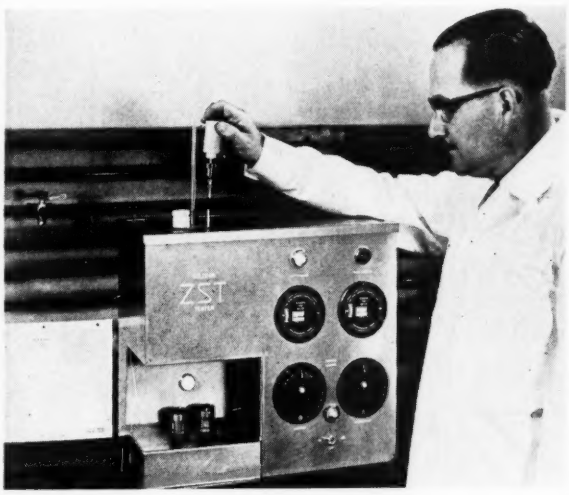


General Electric Co.

Buss's Micro Surfacer

thousands of dollars in reclaimed material by doing away with his shipping of over-sized stock. Overhead is also expected to be lowered by the elimination or reduction of sanding and grinding. Less dust during operation is anticipated, too.

The machine is available in widths from 26-50 inches, with the production of wider machines scheduled for the future.



M. W. Kellogg ZST Tester

Molecular Weight Determiner

A testing apparatus for determining the molecular weights of thermoplastic high polymers during fabrication has been developed by M. W. Kellogg Co., Jersey City, N. J., and is commercially available from F. J. Mullowney Co., Trenton, N. J. Designated Kellogg ZST Tester, it is reported to operate on a 110-volt, 60-cycle system and to consist of an automatic temperature control furnace and components providing for semi-automatic indication of zero strength time. The complete unit is housed in a 10½- by 16- by 18½-inch cabinet.

The procedure involves heating about 20 grams of polymer between ferrous plates to 245-255° C., under pressure for 1-4 minutes and cutting two test strips from the plastic sheet, which has a predetermined thickness, notching them, and inserting them into the tester furnace with 7.5-gm. weights attached to one end. When the strips break, the weights fall into cups, automatically cutting off the timer and recording meters.

The molecular weight of the polymer can then be determined by a two-step procedure of correlating the time in seconds with the solution viscosity in centistrokes, and using this linear viscosity curve to determine the molecular weight..

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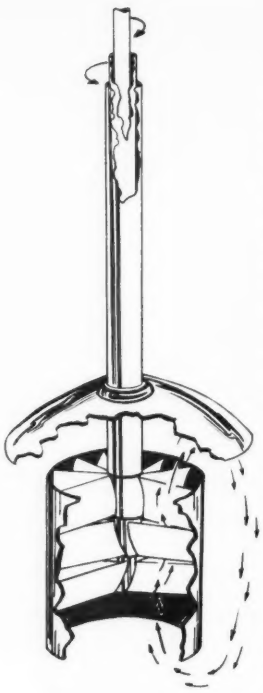
Gabb Shear-Flow Portable Mixer



Cutaway of mixing head of Shear-Flow industrial mixer

An industrial portable mixer for dispersing and homogenizing liquids and pastes has been introduced by Gabb Special Products division of E. Horton & Son Co., Windsor Locks, Conn. Originally developed for mixing textile inks of high viscosity, the Shear-Flow industrial mixer is said to be effective in the dispersion of rubber latex, oils, plastics, and gums.

According to the company, the mixer consists of two impellers and a stator spaced closely together. The impellers rotate in opposite directions, creating a pumping action which moves the material from the bottom upward through the veins of the stator, and a shearing action takes place which breaks up and disperses any particles which are present.

Citing one example of the efficiency of the mixer, the company reports that three minutes were required to disperse a batch of hydrophilic gums in cold water. The same material had previously required 15 minutes of mixing time with other types of machines, and only in steam at 140° F.

This mixer is available with 1½-, 2-, 3-, or 5-hp. motors operating at 1750 rpm. The immersed parts of the mixer are said to be made of corrosion-resistant metals, and internally lubricated ball or needle-type bearings are used throughout. Dispersion is effected without vortex or operating torque and with a minimum of aeration, the company states, and the machine is easy to clean and maintain.

Recorder Ink

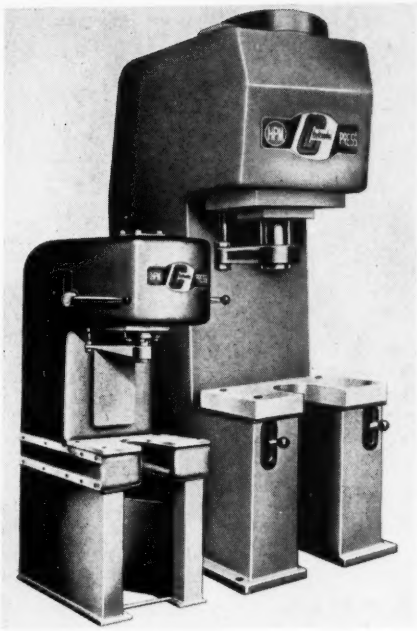
A new, general-purpose recording ink has been introduced by Foxboro Co., Foxboro, Mass., for use with industrial recording instruments. Designated Type 1500, the ink is said to be formulated especially for use with the company's pens and Humitex charts, producing a sharp, quick-drying record of process variables. Physical properties are reported to include smoothness of flow and use at a wide temperature range.

Marketed in a one-ounce, polyethylene squeeze bottle with a plastic capillary tube and filter assembly, the company states that a precise quantity of ink can be deposited directly on the point without dripping or feathering the graph. Five colors are available.

H-P-M C-Frame Presses

A new standard line of oil hydraulic C-frame presses, ranging in size from two to 200 tons and said to be particularly timely in an age of increasing automation which has stepped up the demand for small presses, has been introduced by The Hydraulic Press Mfg. Co., Mount Gilead, O. Sizes include 2-, 5-, 10-, 15-, 25-, 35-, 50-, 75-, 100-, 150-, and 200-ton models, according to the company, with single or dual safety operating levers, electric push-button, foot-switch, foot-pedal, and other standard types among the operating controls available.

Incorporated into each model is a high-speed differential circuit and inching control which allows the press operator to "inch" the ram downward or upward while setting dies, H-P-M says. Also, a specially designed open C-gap frame is provided to eliminate encumbrances within the tooling area and provide



Bench and floor model of H-P-M C-Press

a maximum amount of room for tooling. The "60-second" ram stroke adjustment is said to be conveniently located away from the tooling area.

Series 560 temperature controller by Fenwal, Inc.

Temperature Controller with Thermistor Sensing Element

A temperature controller said to be the first to utilize a thermistor as a sensing element has been introduced by Fenwal, Inc., Ashland, Mass. Called Series 560 Controller, it incorporates such features as selective control, a response differential adjustable down to 0.25% of scale (range of 200-600° F.),

(Continued on page 710)

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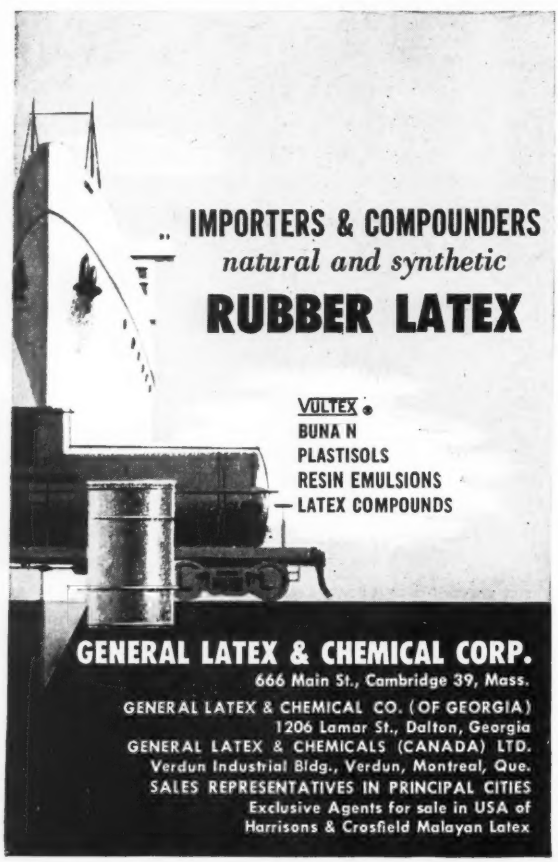
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New Materials

Kel-F Elastomer

Kel-F fluorocarbon rubber, developed by The M. W. Kellogg Co., subsidiary of Pullman, Inc., will be commercially available in the first quarter of this year, according to the company.

Chemically, Kel-F elastomer, as it is called, is a fully saturated fluorocarbon polymer containing more than 50% fluorine by weight. Elasticity combined with high strength has been attained by incorporation of methylene groups in the normally rigid polymer chain. X-ray diagrams show that the polymer is amorphous at temperatures as low as —40° C. On stretching the material to 300%, typical fiber diagrams are observed, indicating susceptibility to orientation and crystal formation. There is no evidence of chain scission or halogen loss after prolonged exposure at 400° F.

The significant physical properties of the raw gum follow:

Specific gravity	1.85
Color	translucent, off-white
Tensile strength, psi.	300-600
Elongation, %	600-800
Shore A hardness	40-45
Intrinsic viscosity, MEK, 30° C.	2-3
Solubility (25% cements)	ketones, esters, ethers
Storage	two years

Recent tests indicate that this unique synthetic rubber will be useful in fields requiring: (1) extreme resistance to fuming nitric acid, oleum, 90% hydrogen peroxide, ozone, oxygen, and weather; (2) thermal stability up to 400° F.; (3) chemical resistance to oils at high temperature, excluding diester types; (4) very low moisture absorption, including electrical insulation.

Kel-F elastomer can be readily compounded, mixed, molded, and extruded, using standard rubber processing equipment. The elastomer does not break down appreciably during milling.

Vulcanization may be achieved by organic peroxides, strongly basic primary and secondary aliphatic polyamines, or a variety of isocyanate-amine combinations. Peroxide cured stocks require metal oxides as accelerators and have excellent physical properties with maximum resistance to oxidative chemical attack. Amine cured stocks can be plasticized with commercial plasticizers and have better compression set and low-temperature properties than peroxide cured stocks; while isocyanate cured stocks are more resistant to oils.

Precipitated silicas and metal silicates are recommended fillers to date, since there has been no success with carbon blacks in Kel-F elastomer.

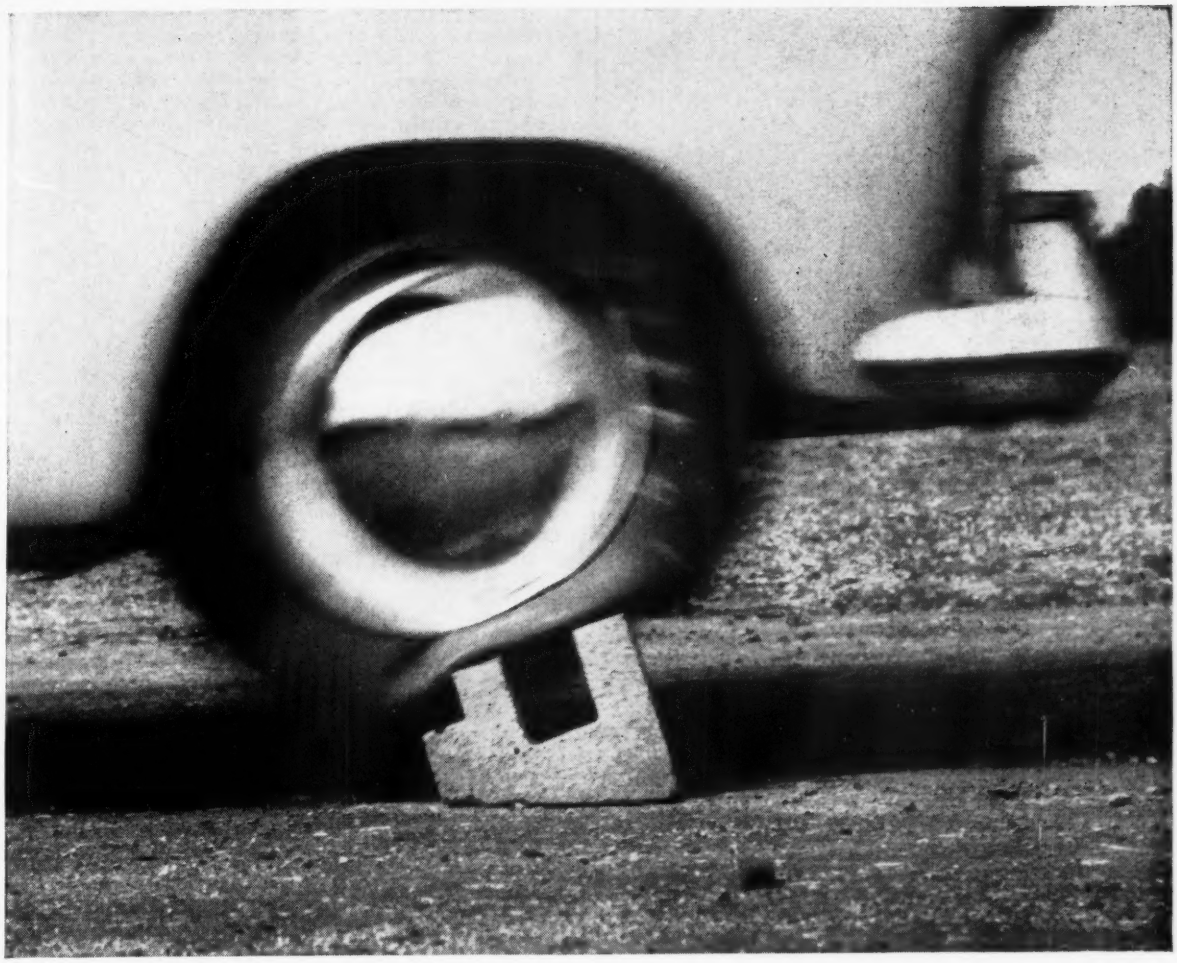
This fluorocarbon rubber is compatible and can be vulcanized with natural rubber, GR-S, nitrile rubbers, neoprene, Butyl, Hypalon, and silicone rubbers.

Among the chemical and heat resistant rubbers, Kel-F elastomer is notable for its high tensile strength (2,000-3,500 psi.), good elongation (400-600%), and good tear strength (150-400 ppi.). Compression set measurements of the compounded material show values as low as 5% at 77° F. and 30% at 212° F.

Kel-F elastomer is available in the form of a white spongy crumb or as compressed sheets.

High-Impact Styrenes—TMD-2155, -5151

Two styrene molding materials, extra-high-impact TMD-2155 and high-impact TMD-5151, have been made commercially available by Bakelite Co., division of Union Carbide & Carbon Corp., New York, N. Y. Both are said to be rubber-modified styrene molding materials with an impact resistance more than three times as great as that of standard high-impact styrenes and to combine excellent physical toughness at room and low



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Tires made with Circosol-2XH have greater resistance to abrasion, and can take impacts and a rougher all around beating than tires made with cheap softeners. Circosol-2XH helps inhibit the spread of cuts and helps tires go through hard driving on hot summer roads without damaging heat build-up.

You can get the full story on the advantages of Circosol-2XH from your local Sun Oil Company Representative—or write Dept. RW-2.

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temperatures with good appearance and without sacrifice of molding characteristics or heat distortion properties.

According to the company, TMD-2155 was especially designed for applications where superior resistance to impact, corrosion, and many chemicals are required; this material is already being used in the molding of fittings for plastic pipe as well as for action-type toys and similar products.

In molding the material, Bakelite suggests a preheating period of one hour at 175° F. to insure faster set and superior quality. Higher mold temperatures than are generally employed in injection molding of the regular grades of styrene are also recommended, with optimum results obtained at 165° F. Best stock temperatures, the company says, are 440-490° F., temperatures that normally will be reached with cylinder temperatures at 450-525° F. Injection pressures higher than normally used will also be required for this extra-high-impact compound.

TMD-5151, produced in an unlimited range of opaque colors, according to Bakelite, is useful in the manufacture of boxes, canisters, dustpans, television masks, toys, luggage, and hardware. Molded refrigerator parts such as inner-door liners, breaker strips, slide rails, shelving, and freezer compartment components have also been found to be satisfactory.

Optimum temperatures for molding are reported at 175° F. for a preheating period of one hour, 150° F. for mold temperature, and 390-440° F. for stock temperature range at indicated cylinder temperatures of 400-475° F.

Fabrication, electrical, mechanical, and miscellaneous test data on the two materials are reported as follows:

	TMD-2155	TMD-5151
Fabrication		
Specific gravity (D792-50)	1.03 to 1.08	1.04 to 1.09
Weight/cu. in. (molded natural), gms.	16.84 to 16.90	17.00 to 17.09
Bulk factor (D1182-51T)	1.80 max.	1.80 max.
Molding shrinkage, in./in. (WC-56-A1/1)	0.002 to 0.008	0.002 to 0.008
Electrical		
Dielectric strength, volts/mil (D149-44)—short time	450 min.	400 min.
Step by step	450 min.	400 min.
Power factor (D150-47T) @ 60, 10^3, 10^6 cycles/sec.	0.0005 to 0.0015	0.0003 to 0.001
Dielectric constant (D150-47T) @ 60, 10^3, 10^6 cycles/sec.	2.45 to 2.55	2.50 to 2.60
Mechanical		
Izod impact strength (D256-47T), ft.-lb./in. of notch 1/8-inch bar		
23° C.	6 to 10	3.0 to 5.0
0° C.	3 to 6	1.5 to 3.0
—25° C.		0.5 to 1.5
Charpy impact strength (D256-47T), ft.-lb./in. of width		
23° C.	20 to 30	12 to 15
—25° C.	20 to 30	12 to 15
Tensile strength (D638-49T), psi	4,000 min.	4,000 min.
Elongation in tension (D638-49T), %	20 min.	25 min.
Flexural strength (D790-49T), psi.	No failure	No failure
Flexural modulus (D 790-49T), psi.	250,000 min.	350,000 min.
Miscellaneous		
Heat distortion temperature (D648-45T) (1/4-inch thick, 264 psi.) °F.	183 min.	174 min.
Thermal coefficient of linear expansion (D696-45T), per °C.	6.5 to 8.5 x 10^{-5}	6.5 to 8.5 x 10^{-5}
Water absorption (D570-50), % gain in weight	0.15 max.	0.12 max.
Rockwell hardness (D785-48T),		
M	—65 to —55	10 to 20
L	20 to 30	65 to 75

Bulletins describing TMD-2155 and TMD-5151, Molding Technical Release No. 72 and No. 62, respectively, may be obtained from the company, 30 E. 42nd St., New York 17, N. Y.

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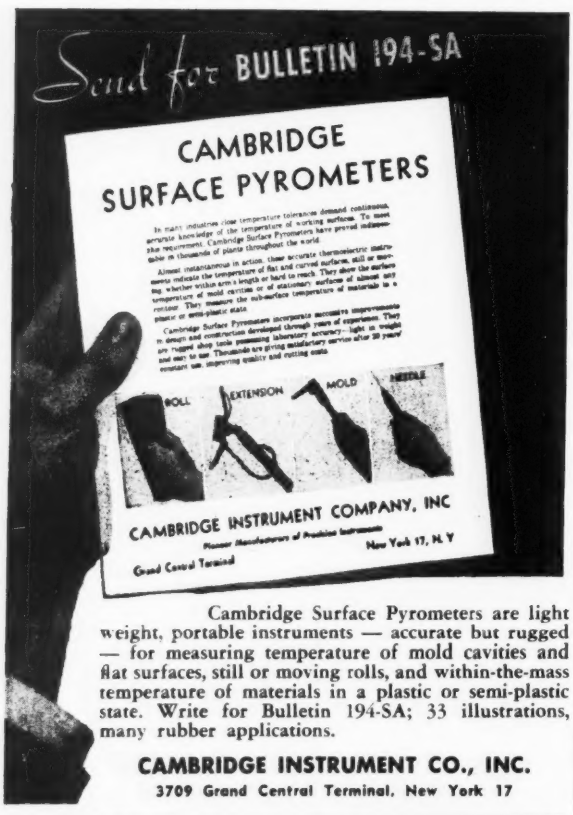

Cambridge Surface Pyrometers are light weight, portable instruments — accurate but rugged — for measuring temperature of mold cavities and flat surfaces, still or moving rolls, and within-the-mass temperature of materials in a plastic or semi-plastic state. Write for Bulletin 194-SA; 33 illustrations, many rubber applications.

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3709 Grand Central Terminal, New York 17

THEY HELP SAVE MONEY AND MAKE BETTER RUBBER

Linde W-96 Silicone Gum

A new type of silicone rubber featuring "controlled reactivity" that is said to have many important advantages over other methyl silicone gums and their compounds has been developed by Linde Air Products Co., division of Union Carbide & Carbon Corp., New York, N. Y. Called W-96 Silicone Gum, the new material has a density of 0.96 (gms./cc. at 25° C.) and an average molecular weight of 600,000. By virtue of the structure of the W-96 molecule, which includes special regularly spaced reactive sites along the polymer chain for the specific catalyst di-tertiary-butyl peroxide, this methyl silicone rubber can be cured with less catalyst to give a better balance of desirable physical properties in the vulcanizate than other silicone rubbers. Other catalysts such as benzoyl peroxide may be used with W-96 Silicone Gum, but since they are not specific for the reactive sites, a lower level of physical properties of the vulcanizate will result.

All fine particle size silicas, diatomaceous earths, metal oxides, and clays currently used for silicone rubbers can be compounded with W-96. A special feature of W-96 is that it can be compounded with a variety of carbon blacks to give vulcanizates with properties similar to those made with conventional silica fillers.

Unusually low compression set, present over a wide range of hardnesses, and using conventional fillers, is another valuable property claimed for W-96, benefiting product designers of such items as gaskets, O-rings, and other molded parts. Also attributed to this new silicone rubber is good resistance to high-pressure steam and the ability to be cured in thick sections without the need of prolonged after-cures. Also, W-96 is relatively insensitive to the use of excessive amounts of catalyst, and with the specific catalyst DTBP, no catalyst residue remains in the cured stock.

The following are reported typical post-cure properties of W-96, compounded to three different hardnesses, which, the company says, point up the superior combination of properties obtainable:

Hardness (Shore A)	40	60	80
Tensile strength, psi.	900	850	800
Elongation, % at break	350	250	170
Compression set, % original deflection, Method B, 22 hrs. @ 350° F.	12	15	20

A booklet entitled "Linde W-96 Silicone Controlled Reactivity Gumstock," describing the material and reporting its physical and chemical properties, compounding, thick section curing, and typical recipes, is available from the company at 30 E. 42nd St., New York 17, N. Y.

Closed-Cell Sponge Rubber—Arco-Cel

A closed-cell, nitrogen-blown sponge rubber has been introduced by Automotive Rubber Co., Inc., Detroit, Mich. Called Arco-Cel, the material is produced from natural, reclaimed, or synthetic rubber in a wide range of densities, sizes, and thicknesses and is suggested for insulating and shock-absorbing applications in the automotive, aircraft, houshold appliance, air conditioning, and sports equipment industries.

Said to be resistant to water and alcohols, special grades of the material are also produced to resist oils and boiling water. Skin coatings on die-cut or molded parts are deemed unnecessary by the company because of the minute cell structure of the sponge. Arco-Cel is lightweight and has insulating qualities equal to or better than those of cork, the firm says.

Oil-Resistant Industrial White Ink

A new industrial white ink that can be used on dark, flexible, or highly polished surfaces and that is fast-drying, impervious to light, and resistant to flushing oil, grease, and moisture, has been introduced by Time Saving Specialties, Minneapolis, Minn. Called Vaporite industrial white ink, it may be removed when

(Continued on page 710)

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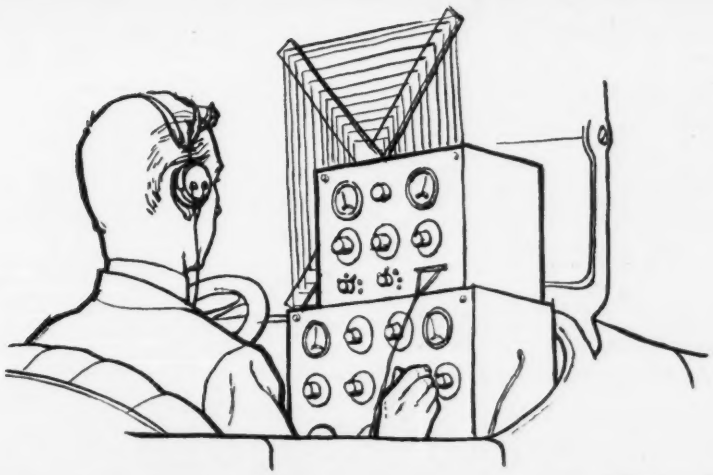

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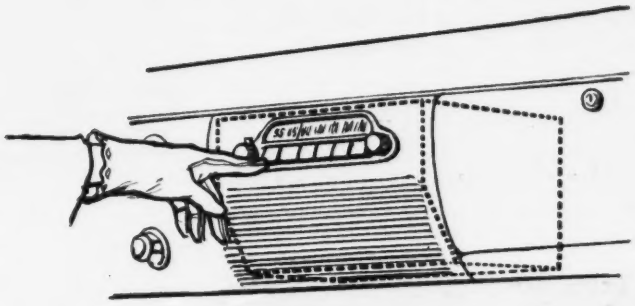

Answer:
Five Years.

Early radios in automobiles, like the 1924 model shown, were apt to be homemade affairs. It wasn't until 1929 that large-scale commercial adaptation started and expanded until now there are about twenty-five million radios in cars.

This rapid development has been typical of all parts of the automotive field including rubber. Here Monsanto has played an important role, steadily increasing the number of chemical products used in improving rubber performance.

For example, Monsanto's nonstaining, non-discoloring Santowhite antioxidants are designed to protect a wide variety of light-colored materials. They deliver superior performance in both synthetic and natural rubbers. Monsanto produces them under rigid quality-controlled conditions to assure uniform quality.

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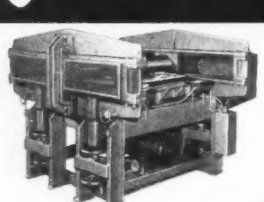

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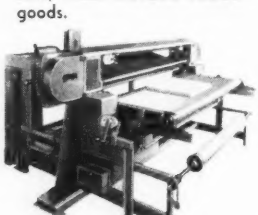

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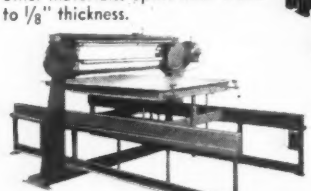

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New Products

Seiberling Tubeless Tire

Production of a new tubeless tire featuring a leakproof inner liner which is part of the tire itself, has been announced by Seiberling Rubber Co., Akron, O. Known as Safety Tubeless, the tire is said to feature patented heat vents, heavy beads with an extra layer of rubber to prevent chafing against the rim, a high-tenacity rayon twisted body, and a cold-rubber tread. The tire has been undergoing tests since 1947.

Rubber Hose for Mining

Rubber hose, designed primarily for use in the mining industry and said to be fortified with an inner lining made of the toughest abrasion-resisting rubber known, has been introduced by the Industrial Products Division of The B. F. Goodrich Co., Akron, O. Called Convertapipe, the new hose is reported capable of moving heavy chunks of iron ore or coal, in addition to abrasive materials such as metal shavings, sand, gravel, and ground chemicals, in a stream of water at pressures up to 250 psi.

The inner lining is composed of a special rubber compound designated Amorite, which, according to the company, outwears steel 20-to-1 in many applications. The hose is particularly recommended in place of metal pipe where the pipe system must turn a corner and is thereby subjected to severe wear from the fast-traveling abrasive particles.

Available in sizes from one inch to 14 inches and in constructions for working pressures from 50 to 250 psi., the hose is reinforced with an interior spiral wire which prevents kinking, crushing, and collapsing.

Davol Silicone Rubber Nipples

Nipples made of General Electric silicone rubber have been introduced by Davol Rubber Co., Providence, R. I. Additions to the firm's Anti-Colic line, the nipples are said to be pleasant tasting, light in color, and can withstand clogging and deterioration.

According to the company, 160 steam sterilizations of the nipples in a 40-day test had no deteriorating effect. Conventional nipples are said to break down under such conditions. In addition, the Davol nipples do not swell or become limp after prolonged use and will last the full length of the baby's nursing period, the company claims.

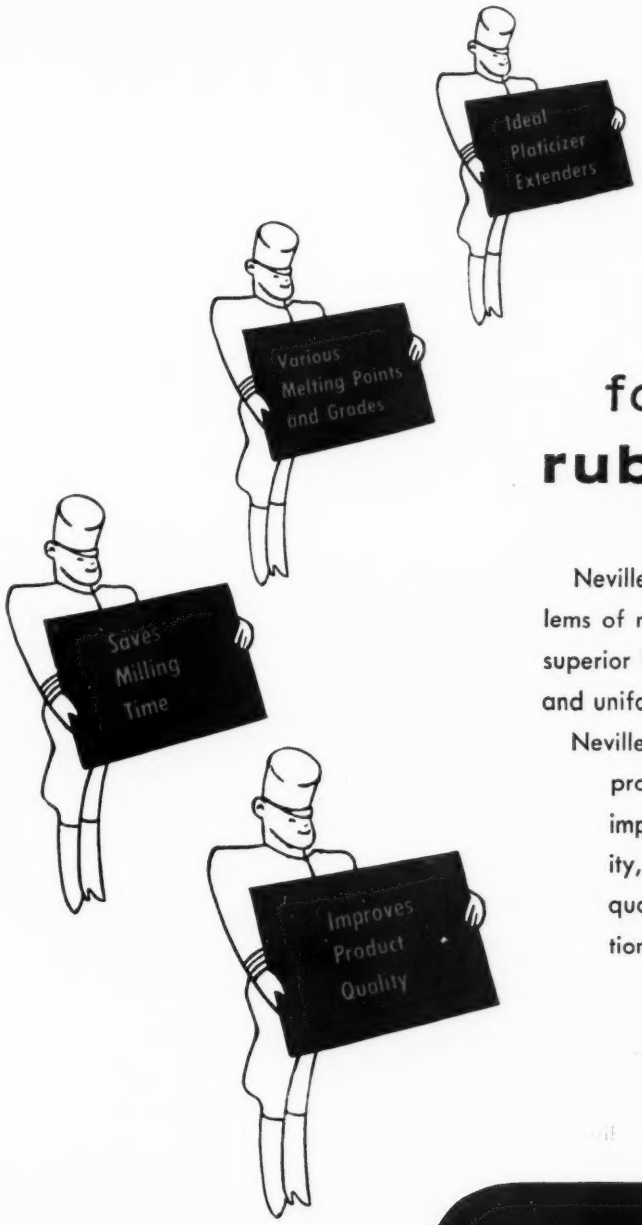
Sizes for both wide-neck and narrow-neck bottles are available. The G-E silicone rubber used was produced at Waterford, N. Y.

Dayton Rubber Co. Tubeless

A tubeless tire said to represent 25 years of research has been introduced by The Dayton Rubber Co., Dayton, O. Called Dayton Thorobred Premium Tubeless Tire, it gives maximum protection against blowouts, according to the company, owing to the absence of the conventional tube and the incorporation of the firm's Electroni-Cord body.

A superior sealing ring design and a special synthetic rubber compound inner liner are reported to make the tire completely airtight. Longer mileage, cooler performance, and increased safety are also claimed for it. Offered with a two-year written service guarantee, the tire is available in all popular sizes, both in black and white sidewall.

Neville Chemicals



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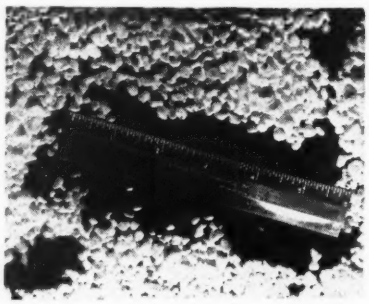

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Rubber Drum Linings

Drumsert Linings

Removable rubber drum inserts for standard 55-gallon drums have been introduced by Automotive Rubber Co., Inc., Detroit, Mich. Called Drumserts, they are preformed linings made of compounded neoprene or sheet rubber and are intended for holding acids and corrosive materials.

According to the company, each insert is made secure by lapping a lip over the edge of the drum and pulling it taut. The metal drum can then be used for electroplating solution make-up, for acid dip, pickle, or strip operations, as test tanks, or for laboratory experimental purposes.

Reinforced Tractor Tires

Front tractor tires said to offer extra protection against sidewall bruising and abrasion have been introduced by United States Rubber Co., Rockefeller Center, New York 20, N. Y. Designated Fisk Tri-Rib R.S. and U. S. Royal Tri-Rib R.S., the tires have a smooth sidewall designed to resist the chipping effect of stubble crops such as alfalfa, cotton, and flax.

According to the company, a reinforced scuffling rib is also built into each tire which is particularly effective where tires are used on tricycle-type (row crop) tractors with high cambered front wheels. The Fisk tire is available in sizes from 4.00-12 with four plies through 7.50-20 with six plies. The U. S. Royal tire is offered in sizes from 4.00-12, two-ply, through 9.00-10, 10-ply.

Parker Aircraft O-Ring

An aircraft-quality O-ring for hydraulic service has been introduced by Parker Appliance Co., Cleveland, O. The new ring is serviceable at temperatures ranging from —65 to +300° F., according to its manufacturer, an increase in range of about 37% over the firm's previous product, which was operable from —65 to +200° F.

The rubber material for the ring, designated Parker Compound Number 590-5, was developed to meet military specifications MIL-P-5516A and MIL-P-18017. The molded O-ring will be marketed in all standard sizes, the company states.

Pre-Pasted Wall Tile

A self-adhesive, washable, flexible vinyl wall tile, in eight- by eight-inch size, said to require only a wetting of the back with water, has been introduced by Bolta Products, a division of The General Tire & Rubber Co., Lawrence, Mass. Called Pre-pasted Bolta-Wall, the tiles are reportedly available in a variety of colors and patterns and are applicable to any smooth-surfaced wall or ceiling.

These tiles have been classified as fire retardant according to U. S. Federal Specifications.

Small Tubeless Tires

Tubeless tires for wheelbarrows and other small vehicles have been introduced by The Goodyear Tire & Rubber Co., Akron, O. Designed for drop-center rims of airtight construction, the new tires are available in two- and four-ply, size 4.80-4.00 x 8, and embody all of the advantages of passenger-car and truck tubeless tires, according to the company.

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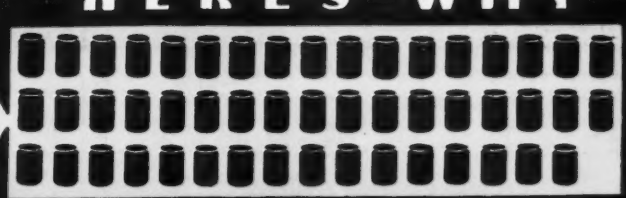

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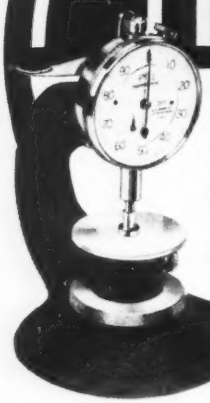

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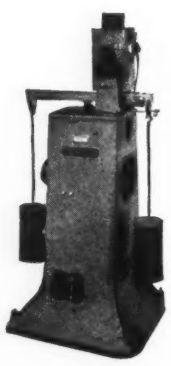

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"Rubber: Natural and Synthetic." H. J. Stern. MacLaren & Sons, Ltd., Norfolk St., W. C. 2, London, England. Cloth, 6 by 10 inches, 508 pages. Price $10.50.

Rubber has become a tremendous subject, not only because of the money value of its products, but because it now comprises so many subordinate topics. The early history of the material culminating along with the Industrial Revolution in the discoveries of Hancock and Goodyear would fill a book. The plantations industry with its agricultural and political ramifications, synthetic rubber and its unusual chemistry, the physics of high polymers, the special engineering required for rubber processing machinery, plus such certain special aspects of the industry as the use of latex could each provide or have provided a volume or more for the five-foot shelf of books on "Rubber."

H. J. Stern is a brave man who has attempted in his book "Rubber: Natural and Synthetic" to squeeze this mountain of material back into a one-volume molehill. Of course the book is particularly addressed to beginners and to engineers and scientists not actually employed in the industry, but the author expresses the hope of interesting the specialist. To a surprising extent he has succeeded in the latter, largely because of his clear, free-flowing style. In addition, his historical approach to each of his many subjects gives the book the flavor of a novel in many instances.

Many points of interest difficult to come by are assembled here. Examples are the full discussion of how factices are made, interesting notes on inorganic pigments, and 26 pages on various carbon blacks. A section designed to show the relation between synthetic rubber and plastics production and the special properties of many of these materials is included. Also of special interest to the American reader is the description of English rubber practices and products.

As an attempt to be comprehensive, however, the book will seem a failure to the rubber specialists. A good example of rubber elasticity has been in existence for 20 years, but the author states that an explanation of the retractive forces in rubber is beyond the scope of this book although elements of the theory are by no means difficult to grasp. The superficial treatment is extended to many of the rubber manufacturing processes, but the most notable fault is still the shying away from the deeper scientific aspects of each topic although that is basically what makes rubber so interesting.

The author's more limited goal of informing beginners and outsiders is certainly reached. To such, the book can be recommended as a good introduction to rubber. Specialists should also read the book for its broad viewpoint.

P. D. Brass

"The Technology of Solvents and Plasticizers." Arthur K. Doolittle. John Wiley & Sons, Inc., New York, N. Y. Cloth, 6 by 9 inches, 1056 pages. Price, $18.50.

Intended as a reference for workers in the fields of paints, varnishes, lacquers, adhesives, inks, synthetic textiles, rubber, and plastics, this comprehensive and apparently definitive tome combines both the theoretical and technological aspects of the subject. Also included are chapters on such commercially pertinent topics as the recovery, handling, storage, and shipping of the raw and finished products. Tabulations and charts report the complete physical and chemical data on 161 solvents and 131 plasticizers available on the general market.

"Deterioration of Materials—Causes and Preventive Techniques." Edited by Glenn A. Greathouse and Carl J. Wessel. Reinhold Publishing Corp., New York, N. Y. Cloth, 6 by 9 inches, 835 pages. Price, $12.00.

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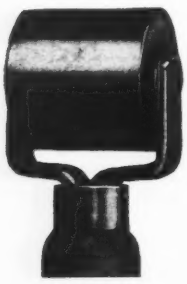

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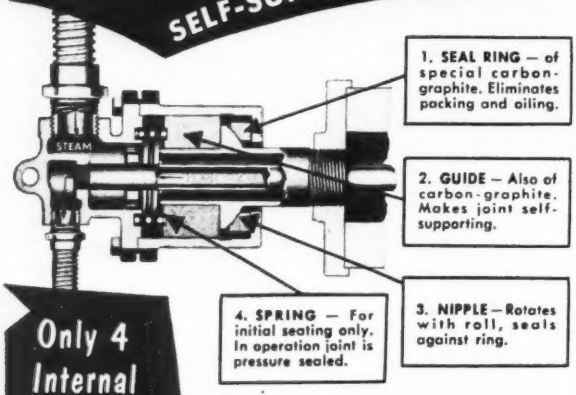
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terioration Center, National Academy of Sciences, National Research Council, and the Services Technical Committee of the United States Department of Defense, this book contains contributions by 24 specialists on the prevention of deterioration in such materials as rubber, plastics, metals, wood, paper, textiles, paint, and many others. The climatic, chemical, physical, and biological agents of deterioration are covered. Illustrations are plentiful, and there is a 1,500 entry documentary reference index to the scientific literature. Also, the foreword is by Vannevar Bush, president of the Carnegie Institution of Washington and wartime director of the Office of Scientific Research & Development.

NEW PUBLICATIONS

"Screw-Type Extruding Machines." Bulletin 195. Farrel-Birmingham Co., Inc., Ansonia, Conn. 32 pages. Described and illustrated here are the company's plasticators, pelletizers, extruders, strainers, strainer-extruders, tubing machines, German mixers, and special-purpose machines for use in the rubber and plastics industries.

"Texas 109." Sid Richardson Carbon Co., Fort Worth, Tex. 24 pages. The chemical and physical properties, comparison with other blacks, performance in various rubbers, factory processing characteristics, and road test results of Texas 109, a super abrasion channel black, are described in this publication.

"Thiokol Liquid Polymer Emulsions." Thiokol Chemical Corp., Trenton, N. J. 10 pages. This bulletin describes the preparation and curing of Thiokol water-based emulsions suitable as binders and impregnants for wood, paper, textiles, felt, and other water absorptive materials, and as a flexibilizer of water-dispersed phenolic, urea, and epoxy resins for coatings and adhesives.

"Report of the Mission of Enquiry into the Rubber Industry of Malaya." Government Press, Kuala Lumpur, Malaya. 76 pages. Price, $1.15. This objective and comprehensive survey of the Malayan rubber industry, already discussed in the November, 1954, issue of RUBBER WORLD, is available from the British Information Services, 30 Rockefeller Plaza, New York 20, N. Y.

"Durez Resins in the Rubber Industry." Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. 6 pages. The firm's phenolic resins and their use in compounding with natural and synthetic rubbers are discussed in this folder.

"Pioneer and Pacemaker." The Firestone Tire & Rubber Co., Akron, O. 64 pages. This is the story of the growth of The Firestone Tire & Rubber Co. from its inception in 1900, when a working force of 12 began producing solid rubber tires for horse-drawn carriages, to its present world-wide organization employing 80,000 people and manufacturing goods worth more than a billion dollars a year. Profusely illustrated with photographs of men and machines, this booklet relates the company's history and describes every phase of its daily operation from the cultivation of Liberian rubber to the after-hours recreational activities of Firestone employes.

"Rules and Regulations Covering Transactions between Sellers and Factory Buyers of Crude Rubber in the United States of America. Also Contract Form." Effective as of January 1, 1955. The Rubber Manufacturers Association, Inc., New York, N. Y. 8 pages.

"1955 Reference Guide." Dow Corning Corp., Midland, Mich. 8 pages. This latest edition of the company's catalog of its silicone products lists and describes 123 items, some only recently developed. Division is by application. Photographs of end-items, property tables, and performance graphs abound.

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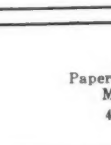

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Publications of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.:

"Neoprene Notebook." No. 62. 8 pages. This issue of the Notebook includes a discussion of the thermal properties of rubber—Part IX in "The Language of Rubber" series. Other topics covered are ocean-going molasses hose, a neoprene-ball sewer cleaning device, and neoprene-coated drip pans in air conditioners and cooling towers for cutting corrosion.

"Neoprene for Adhesion of Elastomer Coatings to Fabrics." BL-272. L. S. Bake. 2 pages. A typical recipe of a neoprene spreading cement for fabrics is reported, as well as an alternate recipe for stronger adhesion.

"Transparent Vulcanizates from Natural Rubber and Neoprene." BL-273. R. W. Bedwell. 4 pages. Two compounding recipes for such vulcanizates are described.

"Colors for du Pont Hypalon." BL-274. O. H. McCollum. 4 pages. The applicable types of red, yellow, orange, blue, and green pigments for compounding with Hypalon are described. In addition to their esthetic function, they fortify the polymer's weathering characteristics.

"A Processing Aid for Silicone Stocks Reinforced with Valron Estersil." BL-275. W. G. Ogden. 4 pages. The effects of General Electric's Masterbatch 81499 on silicone stocks containing Valron are described and tabulated. The additive has been found to be necessary to prevent or delay set-up of the stock.

"Hylene M." 2 pages. Chemical composition, properties, and bonding characteristics of this organic isocyanate, a chemical bonding agent, are described.

"Hylene M-50." 2 pages. This organic isocyanate is said to be more easily incorporated into elastomeric cements than Hylene M, and the resulting material is more stable.

"Valron Estersil." 1 page. Composition, properties, and processing characteristics of this surface-esterified amorphous silica for use as a reinforcing agent for silicone rubber gums and other elastomers are described.

"Neoprene Latex Type 736." 1 page. Used for treating paper. Type 736 is a modified Type 735, having additional stabilizers. Properties, stability, and compounding characteristics are listed.

"Neoprene Latex Type 950." 2 pages. Type 950 is a cationic neoprene latex for treatment of fibrous materials. Properties, stability, compounding characteristics are given.

"Sterling V and Vulcan 6 in Passenger Tire Compounds." Bulletin No. GD-10. T. D. Bolt. Godfrey L. Cabot, Inc., Cambridge, Mass. 7 pages. Physical test data of Sterling V, a GPF large-particle black, and Vulcan 6, an ISAF small-particle black, together with recipes for passenger tire compounding (tread cap stocks and tread base and sidewall stocks), are reported in this booklet.

"Emeryfacts—Specifications and Characteristics." EM-862. Emery Industries, Inc., Cincinnati, O. 4 pages. Specifications of the firm's stearic and oleic acids, animal, hydrogenated, and vegetable fatty acids, oleic esters, special acids and derivatives, and plasticizers are included in this folder.

"Chlorowax in Flame Retardant Rubber Compounds." Diamond Alkali Co., chlorinated products division, 300 Union Commerce Bldg., Cleveland 14, O. 16 pages. This bulletin describes the functions and advantages of the firm's Chlorowax 70 in its application as a resinous modifier with elastomers, and of Chlorowax 40 when used as a non-flammable plasticizer and softener for rubber stocks.

"T. C. Lower Grades." News Sheet No. 7. Natural Rubber Bureau, Washington, D. C. 4 pages. Methods of attaining uniformity in low grades of R.S.S., approached from a packing stage view, are discussed.

"Indulin-70-GR-S in Compounds of Lower Loading." Technical Bulletin 202. West Virginia Pulp & Paper Co., polychemicals division, Charleston A, S. C. 8 pages. This publication describes the properties of Indulin-70-GR-S when additional quantities of rubber are used, reducing the loading of lignin from 70 parts to one part by unit stages. Methods of processing to secure stocks of lower loadings are also outlined.

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Publications of Rubber-Stichting, Delft, Holland:

"Estimation of Rubber in Asphalt." Communication No. 223. Geert Salomon, Elizabeth Pezarro-Van Brussel, and Abraham C. Van Den Schee. 4 pages. A method for determining rubber content in asphalt by prolonged extraction with xylene or higher boiling solvents is discussed in this reprint from *Analytical Chemistry*. Sulfur is added to the rubber in solution, and rubber content is determined by sulfur analysis of the purified ebonite.

"Electron Microscopy of Hevea Latex Gels." Communication No. 266. A. J. De Vries and V. Ch. Dalitz. 5 pages. Reprinted from *Transactions and Proceedings of the Institution of the Rubber Industry*, this bulletin reports and discusses the results of examining a latex film by electron microscope. A drop of latex is spread on a copper object grid, coated with silicon monoxide, and examined for coalescence and particle size.

Publications of Firestone Plastics Co., Pottstown, Pa.:

"Exon 470." 7 pages. Physical properties of this PVC resin and derived coatings are contained in this bulletin. Compatability, solubility, and viscosity data are also given.

"Firestone Butaprene Paint Latices for Styrene-Butadiene Latex Paints." Sales Service Bulletin #B-4. 8 pages. The formulation of a typical paint based on Butaprene paint latex is discussed in this booklet.

"Farmer's Handbook and Almanac." The B. F. Goodrich Co. Tire & Equipment Division, Akron, O. 64 pages.

"40 Precision Finishing Operations." Bulletin No. 451-D. American Wheelabrator & Equipment Corp., Mishawaka, Ind. 18 pages. Forty specific industrial applications of the firm's wet abrasive blasting process for precision cleaning and finishing are described and illustrated in this booklet.

"Strainers for Oil, Water, Steam and Chemicals." Bulletin 9S. Schutte & Koerting Co., Bucks County, Pa. 16 pages. Dimensions, cross-sections, and descriptions of 15 of the company's strainers for high- and low-pressure service are reported in this booklet.

"Newsletter." January 15, 1955. Rubatex Products, Inc., New York, N. Y. 3 pages. Two papers on closed-cell rubber products, published in European technical journals, are discussed.

"Current Safety Topics in the Rubber Industry." Volume 25. National Safety Council, Chicago, Ill. 24 pages. Containing transcripts of major addresses made before the Rubber Section at the 1954 National Safety Congress, the booklet covers seven pertinent topics primarily from the management point of view.

"Type Descriptions and Packing Specifications for Natural Rubber." The Rubber Manufacturers Association, Inc., New York, N. Y. 20 pages. A revision of the booklet on the subject originally issued in 1938, this publication contains a table of contents, a section on official natural rubber type descriptions and one on natural rubber packing specifications, and a glossary of terms.

"Corporate Tax Summary of the 1954 Internal Revenue Code." American Management Association, Inc., New York, N. Y. 45 pages. Price, $2.75. Twelve major areas of corporate taxation embodied in the Internal Revenue Code of 1954 were selected here for comparison and described under three headings—old law, new law, and the AMA's comment.

"Cellosolve and Carbitol Solvents." Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., New York 17, N. Y. 40 pages. Descriptions of the nine commercial glycol-ethers manufactured by the company, together with performance graphs and tables, test methods, and photographs of applications, are included in this booklet.

"CO_2: Applications Unlimited." Liquid Carbonic Corp., Chicago, Ill. 15 pages. The various commercial and industrial uses of gaseous, liquid, and solid carbon dioxide are described and illustrated.

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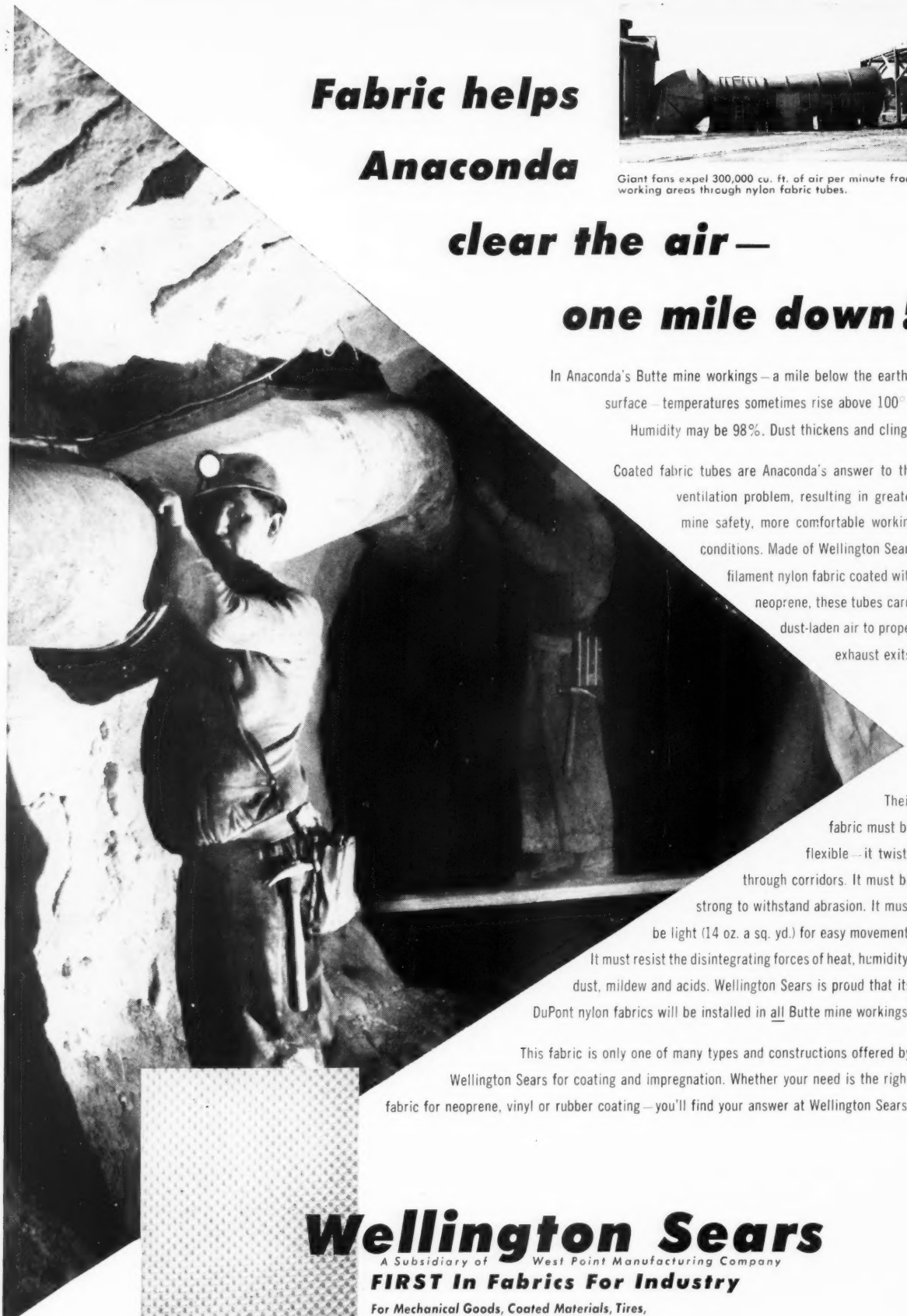

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BIBLIOGRAPHY

Pneumatic Tires for Railways. M. H. Ruhlmann, *Rubber Age (London)*, Aug., 1953, p. 240; Sept., p. 288.

Depolymerization of Natural Rubber. R. A. Moncrieff, *Rubber Age (London)*, Aug., 1953, p. 241.

The Neoprene Latices. W. G. Vennells, *Rubber Age (London)*, Aug., 1953, p. 243; Sept., p. 291; Oct., p. 341.

Synthetic Latices for Surface Coatings. H. J. Stern, *Rubber Age (London)*, July, 1953, p. 203; Aug., p. 245; Sept., p. 295.

Polymerization of Methyl Methacrylate. *Rubber Age (London)*, July, 1953, p. 217; Aug., p. 265; Sept., p. 307.

Cleaning Emulsion Polymerization Equipment Fouled by Synthetic Rubber Latex. J. S. Nettleton, M. J. G. Davidson, H. L. Williams, *Ind. Eng. Chem.*, Sept., 1953, p. 1896.

Polymerization. C. C. Winding, H. F. Wiegandt, *Ind. Eng. Chem.*, Sept., 1953, p. 2011. H. F. Wiegandt, R. G. Thorpe, *Ibid.*, Sept., 1954, p. 1870.

Polybutadiene Modified by Addition of Thiols Containing Polar Groups. C. S. Marvel, K. G. Clarke, H. K. Inskip, *Ind. Eng. Chem.*, Sept., 1953, p. 2090.

Technical Progress and the Rubber Industry. *India Rubber J.*, Aug. 29, 1953, p. 19.

Cyclized Rubber. Developments in Malaya. E. P. B. Edwards, *India Rubber J.*, Aug. 29, 1953, p. 6.

Calibrating Springs for Tensile Machines. R. L. Stafford, *India Rubber J.*, Sept. 5, 1953, p. 8.

Organo-Tin Stabilizers for Vinyl Polymers. H. V. Smith, *Rubber Age (London)*, July, 1953, p. 206.

Latex Paint. *Paint, Oil, Chem. Rev.*, Sept. 24, 1953, p. 22.

Powdered Reclaim. D. S. le Beau, *Rubber Age (N. Y.)*, Sept., 1953, p. 785.

The Use of the Mooney Plastometer to Disclose Structural Effects in High Polymers. D. S. Fensom, *Rubber Age (N. Y.)*, Sept., 1953, p. 795.

A New High Range Strain Gage. J. A. Hurry, R. P. Woolley, *Rubber Age (N. Y.)*, Sept., 1953, p. 799.

Polyethylene Insulated Telephone Cable. A. S. Windeler, *Bell System Tech. J.*, Sept., 1953, p. 1245.

Mechanical Investigations on Elastomers in a Wide Range of Frequencies. W. Philippoff, *J. Applied Phys.*, June, 1953, p. 685.

Epoxy Resins. *Rubber Age (London)*, Sept., 1953, p. 301; Oct., p. 353.

High Pressure in the Manufacture of Polythene. W. R. D. Manning, *Rubber Age (London)*, Sept., 1953, p. 308.

High-Impact Polystyrene. D. R. Crabtree, *Rubber Age (London)*, Sept., 1953, p. 312.

Glass Fabrics as Used by the Plastics Industry. B. J. Brown, *Rubber Age (London)*, Sept., 1953, p. 314; Oct., p. 359; Nov., p. 400.

Cat-Cracking into Plastics. H. Barron, *Rubber Age (London)*, Oct., 1953, p. 343.

Acrylic Scrap as a Source of Monomer. *Rubber Age (London)*, Oct., 1953, p. 349.

Crazing Characteristics of Polystyrene. *Rubber Age (London)*, Oct., 1953, p. 351.

Paper That Is Non-Adherent to Rubber. R. W. Moncrieff, *Rubber Age (London)*, Oct., 1953, p. 357.

The Vinyl Type Polymers. C. E. Schildknecht, *Chem. Eng. News*, Nov. 2, 1953, p. 4516.

The Reinforcement of Butyl with Carbon Black. I. A. M. Gessler, *Rubber Age (N. Y.)*, Oct., 1953, p. 59. **II.** R. L. Zapp, A. M. Gessler, *Ibid.*, Nov., 1953, p. 243. **III.** A. M. Gessler, F. P. Ford, *Ibid.*, Dec., 1953, p. 397. **IV.** J. Rehner, Jr., A. M. Gessler, *Ibid.*, Jan., 1954, p. 561.

Solvent-Resistant Rubber. R. W. Moncrieff, *Rubber Age (London)*, Mar., 1954, p. 111.

Compounding Natural Rubber with Lignin and Humic Acid. F. J. Tibenham, N. S. Grace, *Ind. Eng. Chem.*, Apr., 1954, p. 824.

Superfast GR-S Polymerization at 41° F. J. R. Miller, H. E. Diem, *Ind. Eng. Chem.*, May, 1954, p. 1065.

Sodium Formaldehyde Sulfoxylate in GR-S Polymerization. R. W. Brown, C. V. Bawn, E. B. Hansen, L. H. Howland, *Ind. Eng. Chem.*, May, 1954, p. 1073.

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MARKET REVIEWS

Rubber

Prices on both the spot and futures markets catapulted to surprising highs during the period from December 16 to January 15, with indications strong that these levels would continue unabated. Trading on the New York Commodity Exchange was extremely heavy during the first three weeks of the period; the number of lots bought fell below the 100 mark on only three days, but exceeded 200 on five days, and generally remained in the high 100's. R.S.S. #1 shot to 34.88¢ a pound on December 31 and January 3, a new high level since June, 1952, the final month of fixed prices set by the General Sales Administration. In short, not since free trading was resumed after the Korean hostilities has the price of natural rubber been so high.

This runaway advance had not been predicted a month ago. What had been predicted was the traditional lull over the Christmas and New Year's holidays, but this did not materialize. Speculative activities continued rife, and external unforeseen circumstances added to the total effect. In Singapore harbor 1,800 tons of rubber were destroyed by fire aboard the *Lexa Maersk*. In the Suez Canal an oil tanker struck a bridge and shut off traffic for several days. In Malaya torrential rains seriously cut down potential production figures. Freight space appeared short for January and February shipments on the high seas. A nation-wide railway strike seemed imminent in England. In Washington a reliable report said that the U. S. Government was reviewing its stockpile goal for natural rubber. It was inevitable that all these factors should make for a continuing bull market.

The outlook for the near future is uncertain. The market is expected to remain hypersensitive to external events. It will fluctuate, but the overall statistical position is too sound for a definite reaction to set in. Not until something concrete happens in regard to the price of United States synthetics under private ownership will a trend be apparent.

Returning to statistics for the period under consideration, in futures trading, near-March stocks began the period at 29.45¢, climbed to the record level of 34.40¢ over the year-end holidays, stumbled slightly to 31.85¢ by January 10, then swerved upward to 32.20¢ on January 14.

Sales during the second half of December were 16,620 tons, bringing the monthly total to 27,730 tons.

Sales during the first half of January amounted to 13,280 tons.

COMMODITY EXCHANGE
WEEK-END CLOSING PRICES

Futures 1955	Dec. 18	Dec. 25	Jan. 1	Jan. 8	Jan. 15
Mar.	29.54	31.10	34.40	32.60	32.20
May	29.32	30.58	33.40	32.13	32.00
July	29.20	30.40	32.90	31.75	31.80
Sept.	29.10	30.30	32.65	31.35	31.45
Dec.	29.00	30.15	32.45	31.15	31.30
1956					
Mar.	28.95	30.05	32.35	31.00	31.10
Total weekly sales, tons	5,870	6,380	7,630	8,940	4,340

On the physical market, R.S.S. #1 began the period at 29.50¢ a pound, sped rapidly to the 34.88¢-high at the year's end, suffered a drop to 32.50¢ on January 5, and fluctuated to 32.38¢ by the period's end. On the following trading day, January 17, the price was again in the ascendency, at 33.25¢.

December monthly average spot prices for certain grades were as follows: R.S.S. #1, 30.13¢; R.S.S. #3, 29.88¢; #3 Amber Blankets, 28.75¢; and Flat Bark, 25.27¢.

NEW YORK SPOT MARKET
WEEK-END CLOSING PRICES

	Dec. 18	Dec. 25	Jan. 1	Jan. 8	Jan. 15
R.S.S.: #1	29.50	31.38	34.88	33.13	32.38
2	29.38	31.25	34.75	33.00	32.25
3	29.25	31.13	34.63	32.88	32.13
Latex Crepe					
#1 Thick	33.63	34.75	38.50	36.88	36.38
Thin	32.38	33.88	36.75	36.00	35.13
#3 Amber Blankets	28.00	30.25	32.63	32.00	31.75
Thin Brown Crepe	28.00	29.75	32.25	31.75	31.50
Flat Bark	24.38	27.00	30.25	30.00	29.38

Reclaimed Rubber

Activity continued strong on the reclaimed rubber market during the period from December 16 to January 15 as automotive production soared to record highs. Butyl reclaim remained in vigorous demand, boosting the price of Butyl tubes $2 a ton as previously noted. Many tire manufacturers who have not formerly been excessive purchasers of Butyl reclaim have now begun to dip heavily into the Butyl market to meet their production quotas of liners for tubeless tires. The supply of this reclaim, however, is believed to be adequate. Business generally in the reclaim market is expected to be good in the coming months in view of the high prevailing prices of natural rubber.

Final October and preliminary November statistics on the domestic industry have been released by the United States Department of Commerce. October figures, in long tons, were: production, 23,444; imports, 122; consumption, 22,098; exports, 808; and month-end stocks, 30,395. Preliminary November figures were: production, 22,378; imports, 71; consumption, 22,073; exports, 725; and month-end stocks, 29,822.

The price of Butyl reclaim rose 3¢ a pound during the period. Other prices remained unchanged.

Reclaimed Rubber Prices

	Lb.
Whole tire: first line	$0.10
Fourth line	.0875
Inner tube: black	.15
Red	.21
Butyl	.155
Pure gum, light colored	.23
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

Latex

The *Hevea* latex market was comparatively good during the period from December 16 to January 15, considering the lull usually associated with this time of year. Purchasers who had been holding off for a drop in the general rubber market could see no such situation developing and decided to buy now. Stocks that had been building up in the Far East were quickly dissipated, and though latex prices were marked up in sympathy with R.S.S., they continued to be paid fairly freely during each stage of the advance. Observers are optimistic, pointing to the considerable backlog of buying that must be done.

Final October and preliminary November domestic statistics for natural and synthetic rubber latices appear in the table given below.

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
October	0	7,210	7,527	10,952
November	0	——	8,074	9,867
GR-S				
October	5,046	144	4,347	4,745
November	5,035	80	4,467	5,089
Neoprene				
October	742	0	612	1,001
November	717	0	581	1,061
Nitrile				
October	780	0	376	950
November	558	0	392	945

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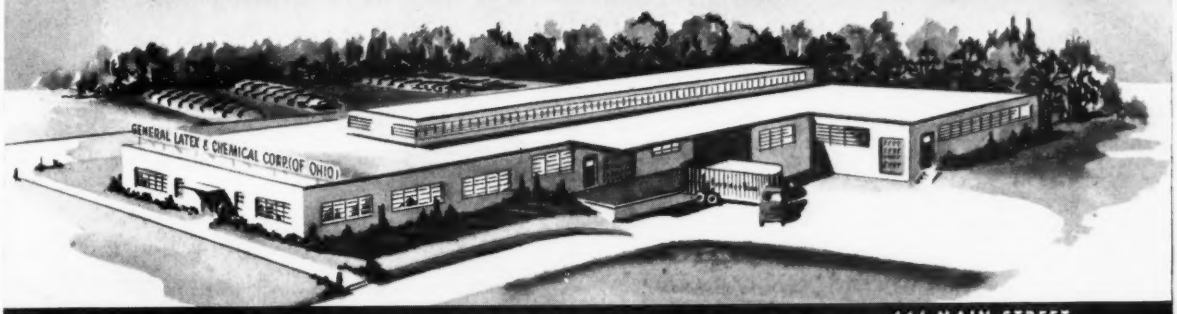

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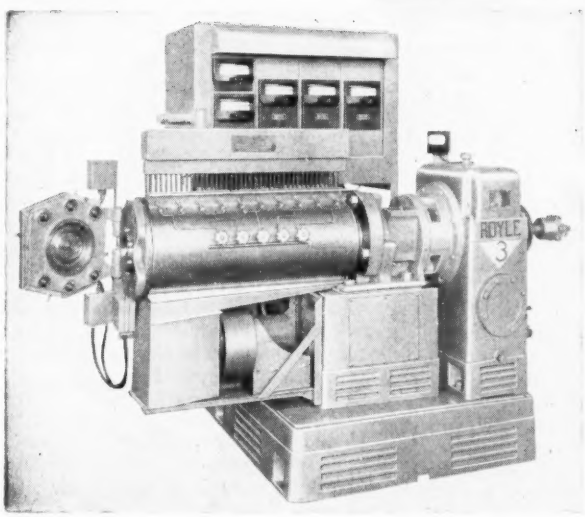

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- **Any heating element may be removed and replaced without disturbing other elements or wiring.**
- **A cooling system with ten times the capacity of conventional designs can be modulated through its entire temperature range without drastic changes. Ample cooling for all compounds at maximum speeds.**

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Scrap Rubber

Trading was routine on the scrap rubber market during the period from December 16 to January 15, with both tires and tubes moving moderately. Consumers appeared to prefer using newly arrived scrap to drawing on their frozen or snow-covered outdoor stockpiles. Activity in early January was restricted mostly to suppliers who are still working on filling old orders of mixed auto tires for Naugatuck and who were anticipating new business for January shipment from the company.

Both exports and imports declined during September, according to the Bureau of the Census, United States Department of Commerce. Scrap rubber exports totaled 1,777,755 pounds, worth $25,967, compared with 2,963,123 pounds, valued at $70,941 in August. Exports for the first nine months of 1954 amounted to 20,941,249 pounds, valued at $518,026. Imports in September were 1,361,712 pounds, valued at $83,393, against 1,992,957 pounds, worth $84,814 in August.

The price of Butyl tubes rose 2¢ a pound during the period at both eastern and Akron points. Tire buffing, however, dropped $1 a ton in the East.

Current dealers' buying prices for scrap rubber grades, in carload lots delivered to mills at the points indicated, are as follows:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$11.00	$11.50
S. A. G. auto tires	Nom.	13.00
Truck tires	Nom.	14.00
Peelings, No. 1	40.00/41.00	40.00/42.00
2	Nom.	Nom.
3	15.50	Nom.
Tire buffing	17.00	15.00/16.00
	(¢ per Lb.)	
Auto tubes, mixed	3.75	3.75
Black	5.00	5.00
Red	7.50	7.50
Butyl	5.00	5.00

Cotton Fabrics

Trading on the industrial fabric market was generally moderate during the period from December 16 to January 15, with demand heaviest for wide industrial fabrics, such as sateens, broken twills and sheetings, and cotton print and broadcloths. Early in the period a large amount of wide drills was bought by fabric coaters and the automotive trades, spurring activity in other industrial goods. The boosted demand enabled mills to reduce their stocks of wide fabrics and increase their order backlogs through the quarter.

About the same time, the cotton osnaburg market was stimulated by two invitations issued by the Philadelphia Quartermaster Depot calling for a total of 1,554,082 linear yards of 6.8-ounce cloth in various colors and widths to be delivered from March through May of next year.

Later, cotton print cloths and carded broadcloths sold in very heavy volume for deliveries running through June, 1955, as well as into the third quarter, as a number of converters and industrial users covered on their requirements. On one day, at the period's end, one large producer sold four to five million yards of the two materials for delivery in the second and third quarters.

Observers predict that the demand for cotton ducks and wide industrial fabrics will continue fairly strong through the first quarter of 1955. Prices have firmed, and the entire scene is in marked contrast to prevailing conditions a year ago.

Price changes were small during the period, and selling prices, f.o.b. shipping point, were as follows on January 17:

Cotton Fabrics

Drills		
59-inch 1.85 yd.	*yd.*	$0.37
2.25-yd.		.31 / .315
Osnaburgs		
40-inch 2.11-yd.	*yd.*	.2425
3.65-yd		.155
Raincoat Fabrics		
Printcloth, 38½-inch, 64x60, 5.35-yd.	*yd.*	.1425/ .145
6.25 yd.		.12
Sheeting, 48-inch, 4.17-yd.		.20
52-inch, 3.85-yd.		.215
Ducks		
38-inch 1.78-yd. S.F.	*yd.*	nom.
2.00-yd. D.F.		nom.
51.5-inch, 1.35-yd. S.F.		nom.
Hose and belting		.67
Chafer Fabrics		
14.40-oz./sq. yd. Pl.	*lb.*	.73
11.65-oz./sq. yd. S.		.65
10.80-oz./sq. yd. S.		.6875
8.9-oz./sq. yd. S.		.70
Other Fabrics		
Headlining, 59-inch, 1.65-yd., 2-ply	*yd.*	.465
64-inch, 1.24-yd., 2-ply		.595
Sateens, 53-inch, 1.32-yd.		.535
58-inch, 1.21-yd.		.585

Rayon

Observers reviewing the 1954 report indicated that it was not a good one for the rayon and acetate industry, with the exception of the rayon staple plus tow branch. Total shipments of rayon and acetate filament yarn and staple plus tow for the first 11 months of the year were 1,001,500,000 pounds, or 8% below the figure for the corresponding period of 1953. Although shipments showed increases in the latter months of 1954, it appears definite that the final results, when available, will be lower than the figure of 1,168,700,000 pounds of rayon and acetate shipped in 1953 and still further below the record level of 1,268,500,000 pounds shipped in 1950.

As for rayon staple plus tow, shipments in the first 11 months of 1954 were 281,600,000 pounds, or 36% greater than the 207,000,000 pounds shipped in 1953.

Shipments of rayon high-tenacity yarn during the first 11 months of 1954 totaled 308,900,000 pounds, 25% lower than the corresponding 1953 figure. Shipments of acetate staple plus tow amounted to 62,900,000 pounds, 25% off the 1953 total. Total acetate and rayon yarn production for the same period was 984,200,000 pounds, a lower figure than shipments; stock held by producers declined to 92,500,000 pounds at the end of November; the year-end 1953 stock figure was 109,800,000 pounds.

No price changes were noted for rayon tire yarn and fabrics during the period, and prices remain as follows:

Rayon Prices

Tire Yarns	
High Tenacity	
1100 /480	$0.62 / $0.63
1100/ 490	.62
1150/ 490	.62
1165/ 480	.63
1230/ 490	.62
1650/ 720	.61
1650/ 980	.61
1875/ 980	.61
2200/ 960	.60
2200/ 980	.60
2200/1466	.67
4400/2934	.63
Super High Tenacity	
1650/ 720	.64
1900/ 720	.64
Tire Fabrics	
1100/490/2	.72
1650/980/2	.695 / .73
2200/980/2	.685

Rubber Division

(Continued from page 651)

Mich, May 4 to 6. The local chairman is J. T. O'Reilly, Ford Motor Co. The first technical session will begin at 2:00 p.m., Wednesday, May 4, with Division chairman, John Ball, Midwest Rubber Reclaiming Co., presiding.

There will be the usual luncheon-meeting of the Division's 25-Year Club on Wednesday noon, and the banquet of the Division will be held on the evening of May 5. Several plant trips will be available to registrants including visits to Chrysler Corp., Detroit Arsenal, Ford Motor Co., General Motors Corp. Technical Center, and United States Rubber Co.

In a letter to the members of the Division dated January 10, Secretary A. M. Neal, E. I. du Pont de Nemours & Co., Inc., stated that the deadline for abstracts of papers for the Detroit meeting is March 8. Abstracts should be of about 200 words, submitted to the secretary in triplicate. Authors in the letter of transmittal must tell the laboratory in which the work was done, who will deliver the paper, and how much time is requested. At least one of the authors, if a resident of the United States, must be a member of the American Chemical Society. Four copies of the finished paper are to be delivered to the secretary at the meeting.

Members will receive further notice of the meeting together with an application blank for room reservations at the hotel.

Diamond Alkali Co., Cleveland, O., is spending $200,000 to modernize and enlarge key facilities of its research center at Painesville, O., to intensify its investigations in the fields of atomic energy, alkali and electrolytic products, plastics, calcium carbonates, chlorinated organics, and chromates.

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LONDON

The I.R.I., which was founded in 1921, is now a great association of people engaged in all branches of the Rubber Industry. Its members include rubber producers, manufacturers, scientists, technologists, executives, students and others, in many countries of the world.

It has reached its present position of authority and respect through the high standard it has set for the technical literature it publishes, the diplomas it awards, and the meetings and conferences it organizes.

In collaboration with other Societies, it aims to raise the standing of the Industry throughout the world by improving the technical qualifications of its personnel, extending the study of its raw materials, processes, and products, and by promoting the exchange of technical discovery and information by means of literature, conferences, and meetings.

Membership of the Institution is open to all interested at an annual subscription of $7.50 which entitles the member to receive the bimonthly Transactions free of charge and to purchase other publications (such as the Annual Reports and Monographs) at reduced rates. It also serves to put him in touch with his colleagues and their work in other parts of the world and confers on him full rights to vote, to nomination for election to the Council and to participate in meetings and Conferences organized by the Institution.

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Statistics of the Rubber Industry

Statistics of the rubber industry have appeared in RUBBER WORLD *for many years. With this issue and every other month thereafter, they will appear as a separate department in which the information not only will be presented in a form more readily available for use by the reader, but will include in most cases figures on an annual basis for the past 10 or more years.*

A few words of explanation are in order. The figures are taken mostly from U. S. Government and Rubber Manufacturers Association sources, and, in general, the tables are presented in the same manner as received. Imports and production of natural, synthetic, and reclaimed rubbers are collected together in one table, however, as has been the consumption of these rubbers. Since these figures include latices, separate tables for production and consumption of latices are necessary. Exports and stocks are shown in still other tables.

U. S. rubber industry wages, hours, and production workers employed are given in yet another table together with the Bureau of Labor Statistics consumers price index.

Automotive tire and tube production, shipments, and inventories are given in other tables, followed by manufacturers sales and inventory figures for all rubber products.

The information contained in this department, except for records of the past 10 or more years, is not in addition to material as previously presented. Other tables may be added in the future if the information to be presented seems desirable and useful. EDITOR.

U. S. A. Consumption of Natural and Synthetic Latices

Year	Natural	GR-S	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1942	9,392	...	200	...	200	9,592
1943	9,578	150	1,400	...	1,550	11,128
1944	6,085	6,000	4,400	...	10,400	16,485
1945	3,886	14,500	6,800	...	21,300	25,186
1946	5,714	23,500	13,000	...	36,500	42,214
1947	13,909	22,500	6,500	...	29,000	42,909
1948	28,489	21,500	5,250	...	26,750	55,239
1949	36,117	21,500	3,750	...	25,250	61,367
1950	56,138	31,000	5,500	...	36,500	92,638
1951	46,750	31,031	6,279	2,628	39,938	86,688
1952	53,567	40,562	7,368	3,093	51,023	104,590
1953						
Jan.	6,097	4,219	739	344	5,302	11,399
Feb.	5,642	3,993	703	302	4,998	10,640
Mar.	6,317	4,502	739	359	5,600	11,917
Apr.	5,937	4,172	764	341	5,277	11,214
May	5,395	4,008	643	310	4,961	10,356
June	5,654	3,950	704	358	5,012	10,666
July	5,100	3,750	554	298	4,602	9,702
Aug.	5,203	3,576	670	343	4,589	9,792
Sept.	5,504	3,599	678	166	4,443	9,947
Oct.	5,897	3,719	660	312	4,691	10,588
Nov.	5,234	3,510	553	244	4,307	9,541
Dec.	5,395	3,475	574	277	4,326	9,721
Total	67,375	46,473	7,981	3,654	58,108	125,483
1954						
Jan.	5,882	3,475	615	275	4,365	10,247
Feb.	5,595	3,568	575	250	4,393	9,988
Mar.	6,610	3,982	729	335	5,046	11,656
Apr.	5,892	3,748	603	324	4,675	10,567
May	5,969	3,394	586	348	4,328	10,297
June	5,884	3,653	629	402	4,684	10,568
July	4,298	2,587	482	296	3,365	7,663
Aug.	5,228	2,834	561	351	3,746	8,974
Sept.	6,903	3,599	628	379	4,606	11,509
Total: 9 mos.	52,261	30,840	5,408	2,960	39,208	91,469

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

U. S. A. Exports of Synthetic and Reclaimed Rubber

(Long Tons)

Year	S-Type	Butyl	Neoprene	N-Type	Reclaimed	Total
1942	222	...	1,037	160	30,405	
1943	14,937	40	2,540	631	15,678	33,286
1944	98,380	530	4,799	557	11,800	116,066
1945	76,555	980	5,837	406	13,413	97,191
1946	68,763	495	2,642	797	14,461	87,158
1947	7,951	62	2,617	755	14,556	25,941
1948	1,093	21	2,875	885	11,428	16,302
1949	1,401	178	3,330	1,574	10,367	16,850
1950	900	31	4,826	1,895	11,740	19,392
1951	483	216	6,825	1,725	14,722	23,971
1952	9,467	126	9,813	2,695	11,180	33,281
1953						
Jan.	298	43	961	165	866	2,333
Feb.	458	114	566	124	950	2,212
Mar.	548	0	930	213	1,115	2,806
Apr.	414	47	818	210	1,261	2,750
May	943	3	1,127	201	964	3,238
June	769	2	741	257	962	2,731
July	765	4	905	236	807	2,717
Aug.	820	3	895	257	638	2,613
Sept.	702	0	1,065	456	894	3,117
Oct.	455	4	915	303	823	2,500
Nov.	729	11	1,155	409	1,086	3,390
Dec.	791	6	1,416	414	1,031	3,658
Total	7,692	237	11,494	3,245	11,397	34,065
1954						
Jan.	618	0	434	295	912	2,259
Feb.	508	2	1,251	287	941	2,989
Mar.	1,265	416	930	288	830	3,729
Apr.	520	62	1,296	454	1,050	3,382
May	1,115	373	844	395	1,071	3,798
June	881	216	694	215	1,068	3,074
July	1,126	421	1,220	358	586	3,711
Aug.	1,314	384	945	307	647	3,597
Sept.	785	53	978	270	641	2,727
Oct.	1,050	219	962	259	644	3,134
Total: 10 mos.	9,182	2,146	9,554	3,128	8,390	32,400

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

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U. S. A. Consumption of Natural (Including Latex), Synthetic, and Reclaimed Rubber

(Long Tons)

Year	Natural	GR-S	S-Types	Butyl	Neoprene	N-Type	Total Natural and Synthetic	Reclaimed	Grand Total
1942	376,791	1,105	1,564	22	6,833	8,217	394,442	254,820	649,262
1943	317,634	131,108	789	304	26,205	12,405	488,525	291,082	779,607
1944	144,113	494,115	1,437	10,763	46,243	14,112	710,783	251,083	961,866
1945	105,429	598,434	1,711	43,012	42,394	8,029	799,009	241,036	1,040,045
1946	277,597	631,405	721	79,228	44,357	5,988	1,039,296	275,410	1,314,706
1947	562,661	446,316	2,273	68,838	37,703	4,536	1,122,327	288,395	1,410,722
1948	627,332	334,233	11,080	58,870	32,118	5,771	1,069,404	261,113	1,330,517
1949	574,522	299,420	21,717	52,664	31,753	8,827	988,903	222,679	1,211,582
1950	720,268	388,427	27,803	66,348	43,781	11,930	1,258,557	303,733	1,562,290
1951	454,015	617,200	9,244	70,500	48,887	13,066	1,212,912	346,121	1,559,033
1952	453,846	648,816	17,604	71,229	55,522	13,866	1,260,883	280,002	1,540,885
1953									
Jan.	47,766	57,472	1,317	7,097	5,516	1,408	120,576	25,356	145,932
Feb.	45,231	54,230	1,250	7,016	5,122	1,270	114,119	24,098	138,217
Mar.	50,707	61,400	1,291	7,913	5,850	1,449	128,610	27,334	155,944
Apr.	49,375	60,546	1,335	8,057	5,908	1,375	126,596	26,483	153,079
May	88,387	57,037	1,068	7,325	5,542	1,262	119,123	25,213	144,336
June	48,224	56,390	872	7,431	5,677	1,381	119,975	24,637	144,612
July	43,929	48,050	866	6,616	4,581	1,186	105,228	23,414	128,642
Aug.	43,732	46,272	746	5,551	5,357	1,315	102,973	22,666	125,639
Sept.	45,225	45,405	862	5,587	5,407	1,391	103,877	22,409	126,286
Oct.	46,744	45,160	990	5,506	5,443	1,416	105,259	21,944	127,203
Nov.	43,251	40,749	855	4,919	4,911	1,236	95,921	19,638	115,559
Dec.	42,400	39,037	981	4,808	4,836	1,240	93,302	18,858	112,160
Yr.-end adj.	....	....	....	....	+1,750	+1,000	+2,750	+3,000	+5,750
Total	553,473	611,748	12,433	77,826	65,900	16,929	1,338,309	285,050	1,623,359
1954									
Jan.	46,960	37,707	982	5,438	4,774	1,272	97,133	19,114	116,247
Feb.	46,897	36,765	942	5,696	4,467	1,190	95,957	19,461	115,418
Mar.	53,709	42,074	1,062	6,300	5,177	1,447	109,769	22,882	132,651
Apr.	51,451	40,194	1,130	6,241	4,684	1,395	105,105	21,883	126,988
May	51,398	40,030	1,144	5,602	4,486	1,366	104,026	20,436	124,562
June	54,253	43,782	1,192	5,961	4,769	1,491	111,448	22,321	133,769
July	37,894	31,474	1,326	4,108	3,499	1,145	79,446	16,301	95,747
Aug.	38,069	30,800	1,596	3,569	4,647	1,439	80,120	17,660	97,780
Sept.	52,412	40,204	1,994	5,138	5,049	1,493	106,290	19,926	126,216
Oct.*	56,167	44,656	2,088	4,622	4,756	1,460	113,749	21,897	135,646
Total: 10 mos.	489,210	387,686	13,456	52,675	46,318	13,698	1,003,043	201,981	1,205,024

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.
* Preliminary.

U. S. A. Imports and Production of Natural (Including Latex and Guayule), Synthetic, and Reclaimed Rubber

(Long Tons)

Year	Natural	GR-S	S-Types	Butyl	Neoprene	N-Type	Total Natural and Synthetic	Reclaimed	Grand Total
1942	282,653	2,278	1,445	23	8,956	9,734	305,089	286,007	591,096
1943	55,329	181,470	789	1,373	33,603	14,487	287,052	304,058	591,110
1944	107,834	668,831	11,118	20,252	56,660	16,812	881,507	260,631	1,142,138
1945	135,672	717,693	7,163	52,378	45,672	7,871	966,449	243,309	1,209,758
1946	400,687	612,687	721	80,823	47,766	5,738	1,148,422	295,612	1,444,034
1947	688,354	405,496	3,362	62,824	31,495	6,618	1,198,149	291,395	1,489,544
1948	735,227	390,240	15,252	56,662	34,848	7,012	1,239,241	266,861	1,506,102
1949	660,792	288,882	21,717	54,046	35,215	11,072	1,071,724	224,029	1,295,753
1950	802,249	350,801	28,086	60,915	50,067	12,037	1,304,155	314,008	1,618,163
1951	733,048	694,583	9,946	76,475	58,907	15,333	1,588,292	366,700	1,954,992
1952	805,997	636,969	17,885	81,630	65,745	16,228	1,624,454	274,981	1,899,435
1953									
Jan.	63,767	55,761	1,351	5,697	6,619	1,570	134,765	27,258	162,023
Feb.	48,455	53,333	1,149	5,738	6,619	1,371	116,665	24,583	141,248
Mar.	56,786	66,253	1,432	7,573	6,220	1,472	139,736	27,964	167,700
Apr.	60,948	66,816	1,236	7,464	7,078	1,654	145,196	29,032	174,228
May	56,280	70,216	900	6,827	6,665	1,752	142,640	27,142	169,782
June	61,423	64,919	843	7,043	6,800	1,541	142,569	26,554	169,123
July	51,091	65,181	889	6,657	6,030	1,594	131,442	23,292	154,734
Aug.	44,181	52,810	601	7,202	6,610	1,646	113,050	22,607	135,657
Sept.	58,625	44,847	1,122	6,771	6,943	2,062	120,370	23,469	143,839
Oct.	46,799	41,290	857	6,736	6,784	2,300	104,766	23,649	128,415
Nov.	49,743	42,167	853	6,036	7,137	1,777	107,713	21,323	129,036
Dec.	45,947	44,793	1,109	6,057	6,990	1,459	106,355	21,463	127,818
Total	647,615	668,386	12,342	79,801	80,495	20,198	1,508,837	298,336	1,807,173
1954									
Jan.	47,170	43,524	853	5,539	6,513	1,620	105,219	20,026	125,245
Feb.	42,645	40,661	1,030	4,801	6,206	1,574	96,917	21,122	118,039
Mar.	47,721	43,372	1,092	5,214	5,190	1,900	104,489	23,383	127,872
Apr.	49,855	34,384	1,167	6,004	5,601	1,645	98,656	21,658	120,314
May	55,983	35,117	1,120	4,581	4,828	1,960	103,589	21,316	124,905
June	66,698	35,829	1,263	3,182	5,101	1,696	113,769	22,342	136,111
July	40,614	35,415	1,388	4,960	4,673	1,814	88,864	18,041	106,905
Aug.	59,124	36,843	1,803	5,003	5,313	1,624	109,710	15,519	125,229
Total: 8 mos.	409,810	305,145	9,716	39,284	43,425	13,833	821,213	163,407	984,620

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

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Address All Replies to New York Office at 386 Fourth Avenue, New York 16, N. Y.

SITUATIONS WANTED

PRODUCTION-DEVELOPMENT ENGINEER AVAILABLE. BROAD technical-practical knowledge of mechanical rubbers, sponge products, and plastics. Cost minded, capable on efficiency, processes, projects, compoundings, and specifications. Address Box No. 1645, care of RUBBER WORLD.

GROUNDED-LIVE WIRE—CHEMICAL ENGINEER. 10 YEARS' diversified experience in Eng. sales, factory process, Research, and Development. Experience includes mechanical goods, coatings, specialty belting, cleaning solutions, cd synthetics and latices, resin emulsions, adhesives. Ready for bigger job. Complete résumé upon request. Age 36. Address Box No. 1646, care of RUBBER WORLD.

RUBBER CHEMIST, WITH 25 YEARS' EXPERIENCE AS COMpounder, development engineer, chief chemist on mechanicals, soling, thread, rolls, cements, latices, and other products, wants a position with smaller company where long experience, ability, and responsibility are appreciated. Address Box No. 1647, care of RUBBER WORLD.

CHEMICAL ENGINEER: RUBBER AND PLASTICS TECHNOLOgist with broad experience in natural and synthetic latices, high polymers, dispersions and plastisols involving laboratory, pilot-plant, process development and plants evaluations of current and new products and technical sales. Good educational background in high polymers. Presently employed, desires position with progressive organization. Address Box No. 1661, care of RUBBER WORLD.

MAN WITH CRUDE RUBBER AND LATEX EXPERIENCE INterested in representing importer or dealer in Central States. Address Box No. 1662, care of RUBBER WORLD.

SITUATIONS OPEN

LATEX FOOTWEAR MANUFACTURING—MANAGER SMALL New England plant. Must have knowledge of all phases of latex; quality production, styling. Future limited only by ability of applicant. All replies held strictly confidential. Address Box No. 1648, care of RUBBER WORLD.

RUBBER CHEMISTS

Degree in Chemistry or Chemical Engineering. Up to five years' experience in rubber and polymer processing, development, or production. Progressive company, well-equipped laboratory, permanent position with opportunity for advancement in expanding operation. Write giving age, experience, and education. Replies held confidential. Box 369, Erie, Pa.

TECHNICAL SALES & SERVICE REPRESENTATIVE

Excellent opportunity and salary for Chem. Eng. or Chemist with sales or service experience to contact latex consumers in pleasant southern states. Rapidly expanding operation offers opportunity for advancement. Please forward résumé to Box No. 1652, care of RUBBER WORLD.

ASSISTANT PRODUCTION MANAGER

Manufacturer of non-defense products offers a challenging opportunity to the right person with experience in Rubber Manufacturing. Requisites for the job are experience in Production Supervision, Production Control, Equipment Maintenance, Practical Mechanical Engineering. Prefer man under 40 who desires to grow into top administrative position. Submit complete résumé with first letter. Address Box No. 1649, care of RUBBER WORLD.

SALES MANAGER WITH CONTACTS

Small molded rubber goods plant also doing rubber lining work. Your connections must primarily give us responsive business on rubber lined equipment first and molded goods second, as our manufacturing endeavor is geared in that manner. A good opportunity exists for properly qualified individual. Address Box No. 1650, care of RUBBER WORLD.

HELP WANTED

National packing manufacturer needs an experienced rubber technologist to devote full time to developing and compounding products for industrial applications from natural and synthetic rubbers. Modern research and development facilities in northern New Jersey. Our employees know of this advertisement. Reply Box No. 1626, c/o RUBBER WORLD.

SITUATIONS OPEN (Continued)

Exceptional opportunity for rubber chemists having from two to five years' experience in the rubber industry and holding degrees in chemistry or chemical engineering. Development and sales service work with well established Eastern firm. Excellent laboratory facilities. Opportunity for contacts with customers, salesmen and production people.

Your reply will be held confidential. Please give age, experience and education.

Employees know of this ad.

ADDRESS BOX NO. 1625, c/o RUBBER WORLD

RUBBER CHEMIST: THREE TO FIVE YEARS' LABORATORY or factory experience, sole and heel industry. Must include cellular expanded soling. Send complete resumé. Salary open. Our employes know of this ad. Address Box No. 1651, care of RUBBER WORLD.

PLANT SUPERINTENDENT

with thorough knowledge of extruded rubber production in the automotive field. Should be experienced in compounding, milling, extruding, and factory processing. This position involves considerable responsibility and is an excellent opportunity for an aggressive man. Medium sized company in Midwest. Please send reply with complete résumé of education and experience. Address Box No. 1653, care of RUBBER WORLD.

VINYL FLOORING CHEMIST

Leading flooring manufacturer has position available for chemist experienced in compounding and processing vinyl flooring or allied products. Experience in rubber compounding helpful, but not essential. Excellent opportunity for right man. Write giving full particulars regarding age, experience, education and salary expected. All replies held in strictest confidence. Our employees know of this advertisement.

Address Box No. 1643, c/o RUBBER WORLD.

RUBBER CHEMIST

An excellent opportunity for a graduate chemist with 3 to 5 years' experience in Rubber Compounding, Developing and Testing, particularly on light-colored mechanical goods. We are located in a pleasant community in Central Ohio. If you are interested in a permanent connection which offers excellent opportunity for the future, write Box No. 1663, care of RUBBER WORLD, giving a complete description of personal history and work background. All replies confidential.

New York Natural Rubber Importer is interested in obtaining the services of a sales representative for the Chicago and Midwest area. Previous selling experience in rubber not particularly necessary but applicant should have a flair for salesmanship. Preferably in the thirties or early forties. Knowledge of Rubber Chemistry would be a good asset. If interested, please give full qualifications. Your letter will be held in strict confidence and will be promptly acknowledged.

ADDRESS BOX NO. 1644, c/o RUBBER WORLD

U. S. A. Imports and Production of Natural and Synthetic Latices

(Long Tons)

Year	Natural	GR-S	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1942	9,595		210	....	210	9,805
1943	1,890	194	1,512	....	1,706	3,596
1944	3,090	6,580	4,683	....	11,263	14,353
1945	4,768	15,176	7,077	....	22,253	27,021
1946	8,012	24,810	13,595	....	38,405	46,417
1947	17,675	22,474	6,089	....	28,563	46,238
1948	32,630	21,494	5,022	....	26,516	59,146
1949	29,974	21,357	3,651	....	25,008	54,982
1950	54,401	31,339	5,725	....	37,064	91,465
1951	54,963	32,972	6,866	2,948	42,786	97,749
1952	48,228	42,273	7,598	4,164	54,035	102,263
1953						
Jan.	6,250	4,290	895	451	5,636	11,886
Feb.	6,339	4,064	819	437	5,320	11,659
Mar.	6,671	4,238	728	407	5,373	12,044
Apr.	6,302	4,472	879	429	5,780	12,082
May	5,548	4,784	721	439	5,944	11,492
June	6,403	4,331	739	425	5,495	11,898
July	6,691	3,997	571	466	5,034	11,725
Aug.	6,649	3,149	753	633	4,535	11,184
Sept.	6,127	3,518	778	582	4,878	11,005
Oct.	6,537	3,654	753	733	5,140	11,677
Nov.	4,826	3,715	754	352	4,821	9,647
Dec.	7,168	3,900	636	490	5,026	12,194
Total	75,511	48,112	9,026	5,844	62,982	138,493
1954						
Jan.	5,396	4,089	592	471	5,152	10,548
Feb.	5,681	3,928	742	375	5,045	10,726
Mar.	5,682	4,142	709	483	5,334	11,016
Apr.	5,663	4,046	803	461	5,310	10,973
May	3,806	3,839	680	623	5,142	8,940
June	6,590	4,019	620	585	5,224	11,814
July	5,236	2,589	448	643	3,680	8,916
Aug.	7,571	1,995	756	682	3,433	11,004
Sept.	6,480	4,190	676	581	5,447	11,927
Total: 9 mos.	52,105	32,837	6,026	4,904	43,767	95,872

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

U. S. A. Stocks of Latex

Year	Natural	GR-S	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1942	13,450	....	....	....	....	13,450
1943	5,638	....	....	....	....	5,638
1944	2,443	....	....	....	....	2,443
1945	3,121	....	....	....	....	3,121
1946	4,865	....	....	....	....	4,865
1947	5,033	....	....	....	....	5,033
1948	11,235	....	....	....	....	11,235
1949	5,063	....	....	....	....	5,063
1950	4,927	....	....	....	....	4,927
1951	4,752	3,727	1,245	532	5,504	10,256
1952	6,201	5,040	1,019	902	6,961	13,162
1953						
Jan.	6,340	4,940	1,143	913	6,996	13,336
Feb.	6,905	5,041	1,167	971	7,179	14,084
Mar.	6,738	4,804	1,075	880	6,759	13,497
Apr.	7,428	4,815	1,233	833	6,881	14,309
May	7,648	5,254	1,163	715	7,132	14,780
June	8,094	5,744	1,069	593	7,406	15,500
July	9,256	5,861	1,162	514	7,537	16,793
Aug.	10,273	5,081	1,127	617	6,825	17,098
Sept.	11,370	4,794	1,122	638	6,554	17,924
Oct.	11,126	4,990	1,133	737	6,860	17,986
Nov.	10,834	4,533	1,064	743	6,340	17,174
Dec.	13,532	4,794	1,117	721	6,632	20,164
1954						
Jan.	12,375	5,001	1,019	703	6,723	19,098
Feb.	13,963	5,269	963	625	6,857	19,820
Mar.	11,870	5,247	975	588	6,810	18,680
Apr.	10,803	5,273	1,062	600	6,935	17,738
May	8,907	5,180	1,110	655	6,945	15,852
June	9,460	5,591	1,020	646	7,257	16,717
July	10,171	5,363	1,004	831	7,198	17,369
Aug.	12,009	4,220	1,019	993	6,232	18,241
Sept.	11,546	4,504	984	908	6,396	17,942

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

U. S. A. Stocks of Synthetic and Reclaimed Rubber

(Long Tons)

Year	S-Types	Butyl	Neoprene	N-Type	Reclaimed	Total
1942	1,050	4	1,786	1,172	42,532	46,544
1943	36,395	1,033	6,644	3,223	46,201	93,496
1944	122,412	9,992	12,262	5,366	43,832	193,864
1945	170,571	18,378	9,703	4,802	28,155	231,609
1946	83,090	19,478	10,470	3,755	33,666	150,459
1947	40,606	13,184	5,237	3,339	35,943	98,309
1948	96,304	10,995	5,072	2,762	32,630	147,763
1949	77,743	12,224	4,654	3,433	28,263	126,317
1950	36,942	7,243	5,733	2,840	35,708	88,466
1951	105,271	12,481	8,379	3,821	45,082	175,034
1952	83,861	22,716	8,535	3,875	30,664	149,651
1953						
Jan.	83,921	21,096	9,001	3,857	31,244	149,119
Feb.	81,550	19,560	9,078	3,911	30,631	144,730
Mar.	84,013	19,581	8,738	3,757	30,280	146,369
Apr.	89,839	19,144	9,364	3,694	31,263	153,304
May	100,873	18,376	8,986	3,874	31,763	163,872
June	112,770	18,141	9,073	3,805	32,791	176,580
July	127,278	18,280	10,036	3,892	31,506	190,992
Aug.	134,936	20,269	10,008	3,939	30,318	199,470
Sept.	132,453	21,280	9,671	4,221	30,147	197,772
Oct.	129,655	22,435	10,138	4,496	30,692	197,416
Nov.	127,464	23,401	11,067	4,591	31,226	197,749
Dec.	135,153	24,866	11,480	4,346	32,319	208,164
1954						
Jan.	138,692	24,733	13,065	4,349	31,865	212,704
Feb.	143,202	23,573	12,518	4,112	32,393	215,798
Mar.	145,178	22,329	12,575	4,202	32,148	216,432
Apr.	136,446	21,673	12,665	4,199	31,359	206,342
May	131,604	20,077	11,467	4,435	31,105	198,688
June	124,678	17,534	10,646	4,314	30,845	188,017
July	128,752	18,150	11,315	4,727	31,304	194,248
Aug.	135,164	19,672	10,710	4,613	27,692	197,851
Sept.	128,313	18,513	10,288	4,548	29,632	191,294
Oct.	127,600	18,615	11,168	4,328	30,873	192,584

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

World Production of Natural Rubber

(1,000 Long Tons)

	Malaya		Indonesia			
Year	Estate	Native	Estate	Native	All Other	Total
1947	360.5	285.8	12.8	265.2	335.7	1,260.0
1948	403.6	294.6	101.7	330.6	394.5	1,525.0
1949	400.8	270.7	169.1	263.9	385.5	1,490.0
1950	376.7	317.4	175.1	521.4	469.4	1,860.0
1951	328.8	276.5	222.5	591.9	465.3	1,885.0
1952	341.7	242.5	293.2	456.0	456.6	1,790.0
1953						
Jan.	31.4	23.6	27.4	39.6	43.0	165.0
Feb.	23.5	19.2	26.4	18.5	32.4	120.0
Mar.	27.0	16.9	25.7	29.2	36.2	135.0
Apr.	26.2	16.9	23.8	30.3	32.8	130.0
May	27.9	17.7	22.9	38.0	33.5	140.0
June	27.3	17.1	24.2	34.0	34.9	137.5
July	30.2	20.5	26.8	38.4	34.1	150.0
Aug.	29.6	21.5	23.2	35.5	35.2	145.0
Sept	29.0	18.5	22.4	36.8	40.8	147.5
Oct.	30.1	19.3	25.2	28.7	41.7	145.0
Nov.	29.0	19.4	24.9	26.0	45.7	145.0
Dec.	30.6	22.0	28.9	35.4	48.1	165.0
Total	341.8	232.6	301.8	390.4	458.4	1,725.0
1954						
Jan.	30.3	19.1	24.2	34.9	44.0	152.5
Feb.	25.4	18.0	23.0	30.2	30.9	127.5
Mar.	24.6	17.5	23.2	36.7	35.5	137.5
Apr.	24.8	15.4	21.2	37.0	34.1	132.5
May	27.6	18.6	22.9	32.9	30.5	132.5
June	27.0	16.3	21.0	33.5	39.7	137.5
July	31.0	23.0	26.8	46.2	38.0	165.0
Aug.	30.9	21.6	21.9	37.1	38.5	150.0
Sept.	30.1	23.4	23.6	46.4	41.5	165.0
Total: 9 mos.	251.7	172.9	207.8	334.9	332.7	1300.0

Source: BDSA, United States Department of Commerce; and Secretariat of the International Rubber Study Group.

CLASSIFIED ADVERTISEMENTS

Continued

SITUATIONS OPEN (Continued)

COST ESTIMATOR—Rubber Products

Must be experienced in rubber manufacturing methods of molded goods and extrusion. Must be alert, accurate, and possess sound judgment. This position involves considerable responsibility and is an excellent opportunity for an aggressive man. Medium sized company in Midwest. Please send reply with complete resumé of education and experience. Address Box No. 1654, care of RUBBER WORLD.

WANTED

We are looking for a man experienced in plastisol and organisol types of vinyl coating to take charge of a vinyl coating plant. Address all inquiries to: Allied Fabric Corp., 92 Brookline St., Lynn, Mass.—Lynn 2-6670.

MACHINERY & SUPPLIES FOR SALE

FARREL 16" x 48" AND 15" X 36", 2-ROLL RUBBER MILLS, AND sizes up to 84". New and used lab. 6" x 12" & 6" x 16" mills and calenders. American Tool 300-gallon Churns. Extruders 1" to 6". Baker-Perkins Jacketed Mixers 100, 50, and 9 gals. HPM 200-ton Hydr. Press 30" x 48" platens, Brunswick 200-ton 21" x 21" platens. 150-ton, 20" x 20" platens. Large stock of hydraulic presses 12" x 12" to 48" x 48" platens. Hydraulic pumps and Accumulators. Rotary cutters, Stokes Molding Presses. Single Punch & Rotary Preform Machines, Banbury Mixers, Crushers, Kux 2½" dia. Preform Machine, Churns, Bale Cutters, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT CO., 107—8th St., Brooklyn 15, N. Y. Sterling 8-1944.

ATLAS HYDRAULICS, INC.

Hydraulic Presses 12" x 12" and 14" x 14" for Laboratory or Production. Inquiries invited for special needs. 3576 Ruth St., Philadelphia 34, Penna.

OAKES CONTINUOUS FOAM RUBBER MIXER

#68-24 AMF Oakes Continuous Mixer, complete with head, rotor, stators, all pumps, hook-up parts, motors (220V., 60-cycle, 3-phase), flowmeter, Chem-O-Feeder, and miscellaneous accessories. Two years old. Complete and ready to run. Capacity 1800 lbs. wet per hour. Address Box No. 1655, care of RUBBER WORLD.

FOR SALE

1—4' x 13' Vulcanizer, Q.O. door; 1—16" x 20" two-opening hydraulic press, 14" ram; 1—6" x 16" Thropp laboratory mill; 2—400-ton compression motor presses; also calenders, Banbury mixers, tubers, et cetera. Chemical & Process Machinery Corp., 146 Grand St., New York 13, N. Y.

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World Production of Synthetic Rubber

(1,000 Long Tons)

Year	U.S.A.	Canada	Germany*	Total
1943	231.8	2.5	115.8	350.1
1944	764.1	34.9	101.6	900.5
1945	820.4	45.8	. . .	866.1
1946	740.0	51.0	5.6	806.6
1947	508.7	42.4	8.2	559.3
1948	488.3	40.5	3.4	532.2
1949	393.7	46.6	. . .	440.3
1950	476.2	58.4	. . .	534.6
1951	845.2	62.3	0.9	908.4
1952	798.6	74.3	4.9	877.8
1953	848.4	80.9	6.3	935.6
1954				
Jan.	57.3	7.3	0.4	65.0
Feb.	53.4	6.7	0.4	60.5
Mar.	55.8	7.4	0.5	63.7
Apr.	47.6	7.1	0.6	55.3
May	46.6	7.3	0.5	54.4
June	45.9	5.9	0.5	52.3
July	47.0	5.8	0.5	53.3
Aug.	48.8	7.3	0.7	56.8
Sept.	51.4	7.9	0.6	59.9
Total: 9 mos.	453.8	62.7	4.7	521.2

Source: Secretariat of the International Rubber Study Group.
* British Zone only from 1945 to 1947; Bizone for 1948 and 1949; Federal Republic since 1950.

World Consumption of Synthetic Rubber

(1,000 Long Tons)

Year	U.S.A.	Canada	United Kingdom	Total† Continent of Europe	World† Grand Total
1943	170.9	3.7	3.3	115.0	292.5
1944	566.7	24.7	41.8	100.0	737.5
1945	693.6	35.9	63.8	55.0	865.0
1946	761.7	29.6	30.1	75.0	912.5
1947	559.7	29.2	2.8	32.5	625.0
1948	442.1	20.6	2.6	15.0	480.0
1949	414.4	18.1	2.4	14.0	450.0
1950	538.3	22.6	2.8	16.0	580.0
1951	758.9	26.4	3.9	22.3	812.5
1952	807.0	33.6	4.9	35.0	885.0
1953	784.8	35.9	4.9	39.3	872.5
1954					
Jan.	50.2	2.6	0.6	3.8	57.5
Feb.	49.1	3.1	0.5	4.0	57.5
Mar.	56.1	2.9	0.7	4.3	65.0
Apr.	53.7	2.7	0.8	4.0	62.5
May	52.6	2.7	0.7	4.0	60.0
June	57.2	2.8	0.7	4.3	67.5
July	41.6	1.9	0.6	4.3	50.0
Aug.	42.1	2.0	0.7	3.5	47.5
Sept.	53.3	2.4	0.8	4.5	62.5
Total: 9 mos.	455.9	23.1	6.1	36.7	530.0

Source: Secretariat of the International Rubber Study Group.
* Includes latices.
† Figures estimated or partly estimated.

U.S.A. Rubber Industry Sales and Inventories

(Millions of Dollars)

	Value of Sales*			Manufacturers' Inventories*		
	1952	1953	1954	1952	1953	1954
Jan.	408	424	348	809	866	844
Feb.	402	435	351	842	868	857
Mar.	400	473	388	857	880	849
Apr.	407	444	375	850	874	812
May	402	422	357	855	888	810
June	409	436	377	851	914	829
July	377	448	374	890	925	784
Aug.	388	409	337	877	897	761
Sept.	427	416	334	871	908	804
Oct.	423	395	332	866	881	838
Nov.	383	346	. . .	850	867	. . .
Dec.	418	369	. . .	877	868	. . .

*Adjusted for seasonal variation.
Source: Office of Business Economics, United States Department of Commerce.

U. S. A. Automotive Pneumatic Casings

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1945 (total)	2,984	36,479	504	42,967	44,524	3,077
Passenger car	1,115	25,463	222	26,800	28,200	2,214
Truck and bus	4,869	11,016	282	16,167	16,324	863
1946 (total)	11,310	65,490	1	82,312	82,298	2,448
Passenger car	11,086	54,684		66,423	66,466	1,763
Truck and bus	4,224	10,806	859	15,889	15,832	685
1947 (total)	13,056	62,871	3,256	91,183	95,550	6,949
Passenger car	11,644	52,857	1,608	74,109	77,795	5,444
Truck and bus	5,412	10,014	1,648	17,074	17,755	1,505
1948 (total)	26,845	49,148	1,787	77,781	81,314	10,698
Passenger car	21,589	41,295	656	63,540	66,738	8,773
Truck and bus	5,256	7,853	1,132	14,241	14,576	1,925
1949 (total)	31,584	43,466	1,467	76,517	76,369	10,638
Passenger car	28,129	36,440	509	65,077	65,140	8,904
Truck and bus	3,456	7,026	958	11,440	11,228	1,734
1950 (total)	41,349	56,808	1,430	99,587	92,754	3,794
Passenger car	36,678	47,103	64	84,423	78,598	3,050
Truck and bus	4,67	9,705	788	15,164	14,156	743
1951 (total)	32,153	44,612	1,677	78,442	83,405	8,765
Passenger car	26,729	34,226	723	61,678	65,546	6,973
Truck and bus	5,424	10,386	954	16,764	17,859	1,791
1952 (total)	29,484	54,342	1,520	85,346	90,411	14,110
Passenger car	24,106	45,458	741	70,305	74,341	11,251
Truck and Bus	5,378	8,884	779	15,041	16,070	2,859
1953 (total)	37,949	55,124	1,543	94,617	96,150	15,720
Passenger car	33,106	45,798	809	79,713	81,455	13,044
Truck and bus	4,843	9,326	734	14,904	14,696	2,676
1954						
Jan. (total)	2,891	3,993	118	7,002	6,299	14,977
Passenger car	2,549	3,378	59	5,986	5,251	12,279
Truck and bus	342	615	59	1,016	1,048	2,698
Feb. (total)	2,634	3,557	117	6,308	7,042	15,709
Passenger car	2,323	3,001	60	5,384	5,952	12,832
Truck and bus	311	556	57	924	1,089	2,877
Mar. (total)	3,163	4,350	116	7,629	7,981	16,077
Passenger car	2,809	3,753	45	6,607	6,878	13,112
Truck and bus	354	597	71	1,022	1,103	2,966
Apr. (total)	3,131	4,935	176	8,243	8,065	15,906
Passenger car	2,785	4,328	95	7,208	7,031	12,955
Truck and bus	346	607	81	1,035	1,034	2,951
May (total)	3,020	5,115	184	8,319	7,965	15,504
Passenger car	2,695	4,503	101	7,300	6,985	12,575
Truck and bus	324	612	83	1,020	980	2,928
June (total)	2,890	6,029	160	9,079	8,796	15,218
Passenger car	2,587	5,326	89	8,002	7,755	12,323
Truck and bus	303	703	71	1,076	1,041	2,895
July (total)	2,782	5,948	155	8,884	6,360	12,640
Passenger car	2,516	5,222	73	7,812	5,605	10,063
Truck and bus	265	725	82	1,073	755	2,577
Grand Total: 7 mos., 1954	20,511	33,927	1,026	55,464	52,508	12,640

Source: The Rubber Manufacturers Association, Inc.

U. S. A. Automotive Inner Tubes

(Thousands of Units)

	Shipments					
Year	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1945	5,988	33,906	411	40,304	41,742	3,627
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,521	31,450	887	63,858	65,114	10,657
1950	41,240	42,671	811	84,723	80,179	—
1951	32,151	32,284	1,071	65,507	67,249	10,094
1952	29,451	32,985	1,014	63,449	65,073	12,036
1953	37,957	36,072	878	74,907	74,425	11,874
1954						
Jan.	2,884	3,892	58	6,834	5,395	10,107
Feb.	2,636	2,908	74	5,617	5,896	10,448
Mar.	3,165	2,774	74	6,013	6,399	10,869
Apr.	3,134	2,770	97	6,001	6,266	11,234
May	3,017	2,900	84	6,002	5,909	11,170
June	2,889	3,657	85	6,631	5,739	10,379
July	2,707	3,471	87	6,265	4,132	8,429
Total: 7 mos.	20,432	22,372	559	43,363	39,736	72,636

Source: The Rubber Manufacturers Association, Inc.

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY & SUPPLIES FOR SALE (Continued)

YOU MAY SEE THIS PKG. UNIT OPERATING IN NEW ENG. PLANT

6"—National Erie Strainer, motor, controls.
20 x 22 x 40 Farrel-B. mill, 75-HP motor.
Batch-Off Machine with 18' festoon rack, Akron Stand. Mold.
Conveyor system from mixing mills to strainer to above mill to batch off. All motors 550V-3P-60C. Everything in excellent condition. Will release in late March.
Package price (on skids)—$9,750. Will consider sale of individual units. Address Box No. 1656, care of RUBBER WORLD.

FOR SALE—ALL IN GOOD WORKING CONDITION AND IN recent use. 1—40" Farrel Rubber Mill with 50-HP 220-volt motor. 1—#5 Allen Extruder. 1—2½ NRM oil-heated plastic extruder with 15-HP Sterling Varidrive motor and 4" x 30 ft. conveyor system. 1—40 x 40 Farrel cast-iron press 20" piston, 16" stroke, 4½" strain rods, 45" between posts with 5 platens. 2 Hydraulic accumulators with 150 cu. ft. pressure tanks. 1—15-HP 2-stage Vickers Hydraulic pump with 550-gal. oil steel reservoir. 3—Sterling varidrive motors 15-HP 220-volt speed 2 to 600 RPM. Steam Platens (40) 20" x 40" x 2½" thick and (23) 38" x 59" x 1" thick. 2—Devine Vacuum Ovens or can be used as drying ovens.
Complete plant approx. 5,000 sq. ft. (additional space available), low rent or can be bought, railroad siding, 15 miles from Boston, including 1—42" Farrel Rubber Mill with 50-HP motor, 1—24" Barry Sheeting Mill with 30-HP motor. 1—Dispatch oven approx. 30,000 sq. in. working capacity. 2—Dinkers gouging and misc. equipment. Plant set up 5 years ago and can be used for plastic silicone, or rubber. Address Box No. 1657, care of RUBBER WORLD.

FOR SALE: 1—FARREL-BIRMINGHAM 6" X 13" 3-ROLL CALENder; 1—Royle #4 extruder, motor driven; 1—Farrel-Birmingham 32" x 92" inverted-L, 4-roll calender, reduction drive D.C. varispeed motor; 4—Wymac 150-ton molding presses, 16" x 16", electrically heated platen; 1—6" x 12" laboratory mill, m.d.; 1—Ball & Jewell #2 rotary cutter, 15-HP motor; 3—#28 Devine vacuum shelf dryers, 19-59" x 78" shelves, complete; 1—Farrel-Birmingham 20" x 22" x 60" mill, top cap frame, Falk reduction drive, 100-HP motor; 2—Farrel-Birmingham 16" x 42" mills with reduction drive and 100-HP motor; 1—Read 2,000-lb. all-steel double-ribbon horizontal mixer; 3—Colton #5½ single punch tablet machines, m.d.; also other sizes Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. WANTED: Your Surplus Rubber Machinery. CONSOLIDATED PRODUCTS COMPANY, INC., 64 Bloomfield St., Hoboken, N. J.; HOboken 3-4425; N. Y. Phone: BArclay 7-0600.

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WANTED: RUBBER MACHINERY, INCLUDING BANBURY mixers, Heavy-Duty Mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Driers, Injection Molding Machines. Will consider a now-operating or shut-down plant. P. O. Box 1351, Church Street Sta., New York 8, N. Y.

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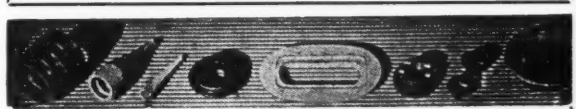

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U. S. A. Rubber Industry Employment, Wages, Hours

Year	Production Workers (1000's)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings	Consumers Price Index
		All Rubber Products			
1939	121	$27.84	39.9	$0.75	
1949	186	57.79	38.3	1.51	101.8
1950	203	64.42	40.9	1.56	102.8
1951	219	68.70	40.6	1.69	111.0
1952	212	74.48	40.7	1.83	113.5
1953	221	77.78	40.3	1.93	114.4
1954					
Jan.	205.7	75.08	38.7	1.94	115.2
Feb.	202.9	75.47	38.9	1.94	115.0
Mar.	199.4	74.31	38.5	1.93	114.8
Apr.	195.2	75.08	38.7	1.94	114.6
May	197.0	77.81	39.7	1.96	115.0
June	198.4	79.60	40.2	1.98	115.1
July	173.1	76.83	39.4	1.95	115.2
Aug.	174.4	76.05	38.8	1.96	115.0
		Tires and Tubes			
1939	54.2	$33.36	35.0	$0.96	
1949	83.6	63.26	36.4	1.74	
1950	87.8	72.48	39.8	1.82	
1951	90.8	77.93	39.6	1.97	
1952	92.9	85.65	40.4	2.12	
1953	93.0	88.31	39.6	2.23	
1954					
Jan.	86.4	82.88	37.5	2.21	
Feb.	85.3	83.03	37.4	2.22	
Mar.	84.7	80.89	36.6	2.21	
Apr.	83.2	84.14	37.9	2.22	
May	83.9	88.65	39.4	2.25	
June	85.0	92.06	40.2	2.29	
July	67.3	87.01	38.5	2.26	
Aug.	68.1	85.56	37.2	2.30	
		Rubber Footwear			
1939	14.8	$22.80	37.5	$0.61	
1949	21.6	48.94	38.6	1.27	
1950	20.6	52.21	40.1	1.30	
1951	25.3	57.81	41.0	1.41	
1952	22.9	62.22	40.4	1.54	
1953	23.7	65.60	40.0	1.64	
1954					
Jan.	21.5	62.98	38.4	1.64	
Feb.	20.5	65.57	39.5	1.66	
Mar.	19.6	65.51	39.7	1.65	
Apr.	19.2	63.58	38.3	1.66	
May	19.8	65.46	39.2	1.67	
June	19.8	67.30	40.3	1.67	
July	20.1	68.45	40.5	1.69	
Aug.	17.5	64.19	38.9	1.65	
		Other Rubber Products			
1939	51.9	$23.34	38.9	$0.61	
1949	80.9	54.38	40.1	1.36	
1950	94.3	59.76	42.2	1.42	
1951	102.9	63.26	41.4	1.53	
1952	96.0	66.58	41.1	1.62	
1953	104.1	70.93	41.0	1.73	
1954					
Jan.	97.8	70.62	39.9	1.77	
Feb.	97.1	70.40	40.0	1.76	
Mar.	95.1	70.22	39.9	1.76	
Apr.	92.8	69.30	39.6	1.75	
May	93.3	70.98	40.1	1.77	
June	93.6	70.98	40.1	1.77	
July	85.7	70.62	39.9	1.77	
Aug.	88.8	70.98	40.1	1.77	

Source: BLS, United States Department of Labor.

World Consumption of Natural Rubber

(1,000 Long Tons)

Year	United States	U.S.S.R. and China	United Kingdom	Other Foreign	Total Foreign	Grand Total
1947	562.7	57.2	153.6	336.5	547.3	1,100.0
1948	627.3	121.0	193.7	480.5	795.2	1,422.5
1949	574.5	132.5	184.3	546.2	863.0	1,437.5
1950	720.3	152.5	219.7	612.5	984.7	1,705.0
1951	454.0	136.3	234.2	675.5	1,046.0	1,500.0
1952	453.8	146.8	197.3	652.1	996.2	1,450.0
1953						
Jan.	47.8	10.8	17.9	58.5	87.2	135.0
Feb.	45.2	18.2	15.4	56.2	89.8	135.0
Mar.	50.7	18.5	15.6	60.2	94.3	145.0
Apr.	49.4	11.0	18.4	58.7	88.1	137.5
May	46.9	11.3	16.3	58.0	85.6	132.5
June	48.2	5.0	15.7	63.6	84.3	132.5
July	43.9	3.1	16.8	63.7	83.6	127.5
Aug.	43.7	2.0	14.2	55.1	71.3	115.0
Sept.	45.2	9.3	17.8	65.2	92.3	137.5
Oct.	46.8	3.8	21.3	65.6	90.7	137.5
Nov.	43.3	4.4	20.2	82.1	106.7	150.0
Dec.	42.4	4.5	17.0	66.1	87.6	130.0
Total	553.5	101.9	206.6	753.0	1,061.5	1,615.0
1954						
Jan.	47.0	7.8	20.3	67.4	95.5	142.5
Feb.	46.9		17.5	70.6	88.1	135.0
Mar.	53.7	2.7	19.1	72.0	93.8	147.5
Apr.	51.4	15.5	19.7	68.4	103.6	155.0
May	51.4	1.1	18.8	66.2	86.1	137.5
June	54.3	3.6	18.0	64.1	85.7	140.0
Total: 6 mos.	304.7	30.7	113.4	408.7	552.8	857.5

Source: BDSA, United States Department of Commerce.

White Ink

(Continued from page 682)

desired with solvents furnished with each marking set containing the ink.

The ink is said to be capable of adhering to an almost limitless range of surfaces including rubber, polished aluminum, glass, rough castings, metal containers, cellophane, wood, photographic film and negatives, varnished or lacquered surfaces, and tile.

Designed especially for use with it are the company's Jiffy-Rite felt-nib fountain pen, filled with a squeeze of a bulb, and a base and holder.

Suggested uses for the ink include circling defective holes and rivets, marking parts for production-line assembly, code marking, inventory and bin marking, wiring diagrams, marking templates before flushing with cutting oil, marking weights, and production charts.

Temperature Controller

(Continued from page 677)

mechanical and electrical stability, and simplicity of operation and maintenance, according to the company.

These advantages accrue from the use of the thermistor as a sensing element which has a large resistance change in response to temperature change, and extremely small mass, Fenwal states. Also, delicate pyrometers are eliminated. The sensitivity of the unit is less than 1° F. for the range. The sensing probe may be connected to the control unit by any standard electrical wiring up to 200 feet in length.

Linear Class 2 Thermometer

A vapor-pressure actuated thermometer system which records on uniform instead of expanded charts has been introduced by Bristol Co., Waterbury, Conn. According to the company, a varying-ratio linkage converts non-linear vapor pressure-temperature curves into linear deflections of the recording pen; the effective linkage ranges from —20 to 600° F.

The thermometers are said to be particularly useful for partial-range and short-span automatic controllers, owing to their large torque and high speed response, small bulb size, extra sensitivity, uniform gradations, and simplicity of control attachments for gas or liquid filled systems.

For cross ambient ranges, a dual-filled system with uniform scale replaces fully compensated Class I thermometers. Dual filled, linear systems are used for ranges under 200° F.

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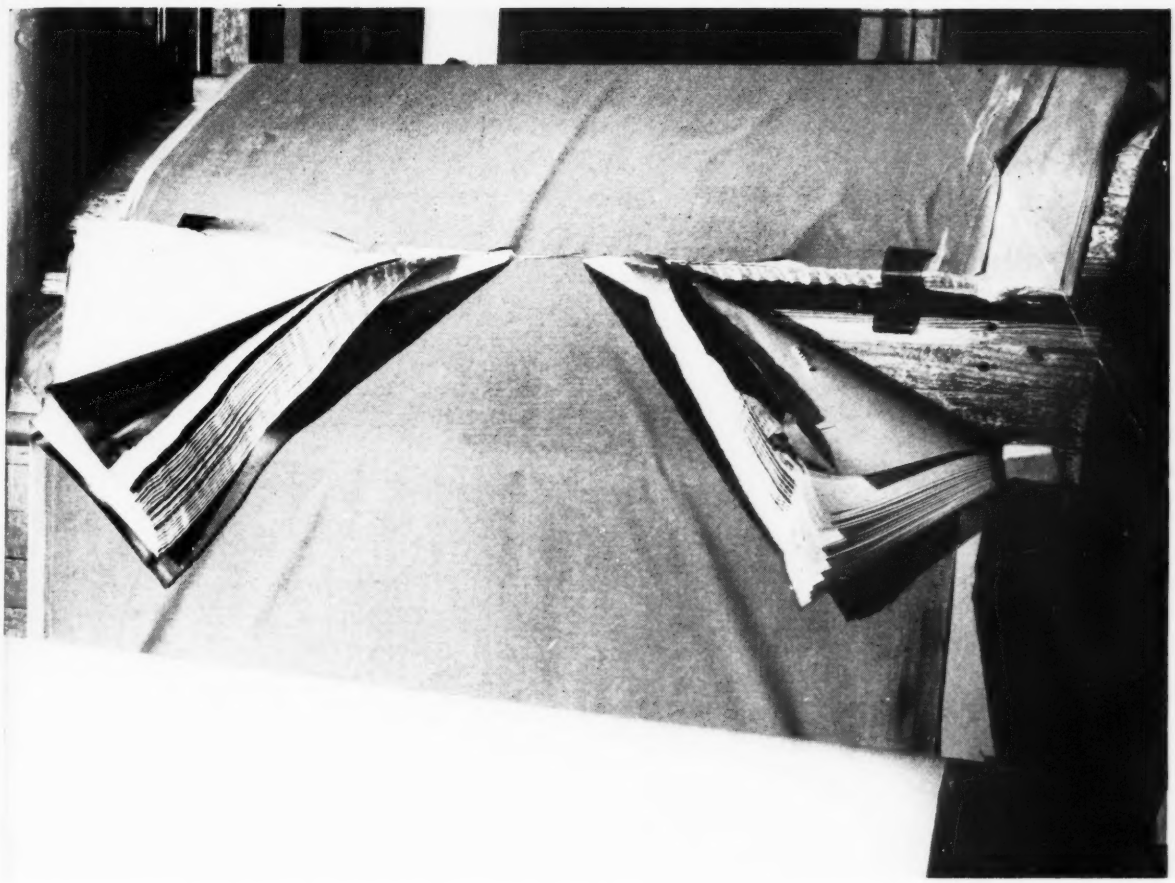

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